NOTICE

All drawings located at the end of the document.

RF/RMRS-2000-021

Sampling and Analysis Plan for the D&D Groundwater Monitoring of Buildings 707, 776/777, 371/374, 865, and 883

Draft Final
Revision 0

April 2000

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SAMPLING AND ANALYSIS PLAN FOR THE D&D GROUNDWATER MONITORING OF BUILDINGS 707, 776/777, 371/374, 865, and 883

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Draft Final
Revision 0

April 2000

This Sampling and Analysis Plan has been reviewed and approved by:

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ACRONYMS AND ABREVIATIONS

ALARA	As Low As Reasonably Achievable
Am	Americium
ASD	Analytical Services Division
Be	Beryllium
Bgs	Below Ground Surface
CDPHE	Colorado Department of Public Health and the Environment
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
D&D	Decontamination and Decommissioning
DER	Duplicate Error Ratio
DOE	U. S. Department of Energy
DQO	Data Quality Objective
EPA	U. S. Environmental Protection Agency
ER	Environmental Restoration
FID	Flame Ionization Detector
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FO	Field Operations
ft	feet
$H2SO_4$	sulfuric acid
HCl	hydrochloric acid
HF	hydrofluoric acid
HNO_3	nitric acid
HRR	Historical Release Report
ID	inside diameter
IHSS	Individual Hazardous Substance Site
IMP	Integrated Monitoring Plan
K-H	Kaiser-Hill
LLW	Low-level waste
MCL	Maximum Contaminant Level
msl	Mean Sea Level
OPWL	Original Process Waste Line
OU	Operable Unit
PA	Protected Area
PAC	Potential Area of Concern
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	Photoionization detector
PM	Project Manager
PPE	Personal protective equipment
Pu	plutonium
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPD	Quality Assurance Program Description

ACRONYMS AND ABREVIATIONS (continued)

RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RMRS	Rocky Mountain Remediation Services, L.L.C.
RPD	Relative Percent Difference
RWP	Radiological Work Permit
SAP	Sampling and Analysis Plan
sec	second
SNM	Special Nuclear Material
SOPs	Standard Operating Procedures
SWD	Soil and Water Database
TAL	Target Analyte List
TCA	trichloroethane
TCE	trichloroethene
TCFM	trichlorofluoromethane
TCL	Target Compound List
TOC	total organic carbon
U	uranium
UBC	under building contamination
UHSU	Upper Hydrostratigraphic Unit
VOC	volatile organic compound
yr	year

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LIST OF APPLICABLE STANDARD OPERATING PROCEDURES (SOPs)

Identification Number	Procedure Title
RF/RMRS-98-200	*Evaluation of Data for Usability in Final Reports*
2-S47-ER-ADM-05.14	*Use of Field Logbooks and Forms*
4-501-ENV-OPS-FO.03	*Field Decontamination Operations,*
RMRS/OPS-PRO.070	*Decontamination of Equipment at Decontamination Facilities*
4-H66-ER-OPS-FO.05	*Handling of Purge and Development Water*
RMRS/OPS-PRO.081	*Surface Water Sampling*
RMRS/OPS-PRO.112	*Handling of Decontamination Water and Wash Water*
RMRS/OPS-PRO.069	*Containing, Preserving, Handling and Shipping of Soil and Water Samples*
5-21000-OPS-FO.15	*Photoionization Detectors and Flame Ionization Detectors*
5-21000-OPS-FO.16	*Field Radiological Measurements*
RMRS/OPS-PRO.101	*Logging Alluvial and Bedrock Material*
RMRS/OPS-PRO.117	*Plugging and Abandonment of Boreholes*
5-21000-OPS-GT.06	*Monitoring Well and Piezometer Installation*
RMRS/OPS-PRO.102	*Borehole Clearing*
RMRS/OPS-PRO.123	*Land Surveying*
RMRS/OPS-PRO.124	*Push Subsurface Soil Sampling*
RMRS/OPS-PRO.114	*Drilling and Sampling using Hollow-Stem Auger and Rotary Drilling and Rock Coring Techniques*
RMRS/OPS-PRO.105	*Water Level Measurements in Wells and Piezometers*
RMRS/OPS-PRO.106	*Well Development*
RMRS/OPS-PRO.108	*Measurement of Groundwater Field Parameters*
RMRS/OPS-PRO.113	*Groundwater Sampling*
RMRS/OPS-PRO.072	*Field Data Management*
3-PRO-140-RSP-09.03	*Radiological Characterization of Bulk or Volume Solid Materials*
RM-06.02	*Records Identification, Generation and Transmittal*
RM-06.04	*Administrative Record Document Identification and Transmittal*

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1.0 INTRODUCTION

1.1 Purpose

D&D Groundwater monitoring is required under the Rocky Flats Integrated Monitoring Plan (IMP), which has captured regulatory requirements from The Rocky flats Cleanup Agreement (RFCA) (DOE et al, 1996) and The Interim Measures/ Interim Remedial Action Decision Document for the Rocky Flats Industrial Area (DOE, 1994a).

This Sampling and Analysis Plan (SAP) provides for well installation and decontamination and decommissioning (D&D) groundwater monitoring of Building 707, Building 776/777, Building 371/374, and Buildings 865 and 883 with respect to pre- and post-demolition hazardous and radiological site constituents. These activities are designed to accomplish the objective of assessing the potential impact of D&D activities on local groundwater quality. Implementation of this project will be performed in accordance with the Rocky Flats Cleanup Agreement (RFCA), the Rocky Flats Integrated Monitoring Plan (IMP), as well as DOE Orders and Rocky Flats Environmental Technology Site (RFETS) policies and procedures.

Field activities planned under this SAP are limited to well installation, well development, and initial groundwater sampling activities. The general philosophy of this program is to install new monitoring wells before D&D activities begin, analyze sample results to create a pre-D&D baseline, and continue to sample semi-annually for approximately five years after demolition. The Groundwater Monitoring Program as specified in the IMP will accomplish additional groundwater sampling with regard to long-term D&D monitoring. Any changes to this SAP with regard to building-specific analyte lists or timing of sampling events will be documented through the IMP.

The objective of this SAP is to define specific data needs, sampling and analysis requirements, data handling procedures, and associated Quality Assurance/Quality Control (QA/QC) requirements for this project. All work will be performed in accordance with the RMRS Quality Assurance Program Description (QAPD) (RMRS, 1999a).

1.2 Background

1.2.1 Building 707

Building 707 is located on the north side of Central Avenue between Eighth and Ninth Streets, in the Protected Area (PA), at the Rocky Flats Environmental Technology Site. It is just south of the Building 776/777 complex. Building 707 is a two-story building with a single story section on its east side. The two-story portion is 72,240 square feet, while the single story section is 18,560 square feet. The main floor of the building is compartmentalized into eight modules (A through H). There is a small basement (called the C-pit) under Module C with an area of 1,000 square feet. During its operation, no significant changes were made to the building design. Figure 1-1 presents a site location map of Building 707 and the surrounding area.

Construction of Building 707 began in 1967 to support production of the Part V weapons design that could not be fully accommodated in Building 776/777. Because of a major fire in 1969 at Building 776/777, Building 707 acquired additional plutonium foundry, casting and machining functions that were moved from Building 776/777. After the fire in Building 776/777, Building 707 became the main plutonium components production facility at the plant. Plutonium manufacturing operations began in May 1970 and between 1970 and 1989, Building 707 provided metallurgical support for plutonium and was involved in final product assembly. Plutonium was cast into ingots in the foundry, then rolled and formed prior to being machined, cleaned, and assembled in various areas within the building. Plant operations involving radioactive and fissile material were discontinued in 1989. As of 1992, certain non-production operations had resumed in Building 707.

Seven Potential Areas of Concern (PACs) associated with Building 707 are listed in the RFETS *Historical Release Report* (HRR) (DOE 1992b). The PACs were established as the result of documented spill incidents. Only PACs that are pertinent to this investigation, which means that they are located in Building 707 or immediately adjacent to the building, are discussed in Section 1.2.6, Potential Areas of Concern.

The following process wastes have been generated by activities conducted in Building 707:

- Acids: nitric acid (HNO_3) suspected;
- Bases: potassium hydroxide;
- Solvents: acetone, ethyl and isopropyl alcohol, trichloroethene (TCE), 1,1,1-trichloroethane (TCA), carbon tetrachloride;
- Radionuclides: uranium (U), plutonium (Pu), americium (Am), and neptunium;

- Metals: beryllium (Be), silver, lead, chromium, mercury; and
- Others: oil (machining coolant), Freon 113, polychlorinated biphenyls (PCBs)

Of the above listed potential contaminants, the most abundant associated with Building 707 are plutoniun, americium, uranium isotopes, chlorinated solvents, and a variety of metals including lead, chromium, and mercury.

Building 707 is moderately to highly contaminated with plutonium and some enriched uranium. There is also some beryllium contamination in the building. The two large tanks and 16 pencil tanks located in the Building 707 C-pit were previously used for storage of mixed waste carbon tetrachloride and machine oil, and waste TCA. These tanks are operationally empty and the lines in and out of the C-pit are locked out and tagged out (DOE 1994a). There is no mention in site literature if the tanks were cleaned and the possibility exists that they contain organic residues.

The north-south portion of Building 707 has a gravity flow foundation drain system at an approximate elevation of 5982 feet above mean seal level (msl). The drain is located at elevations that do not greatly impact localized potentiometric contours, based on the potentiometric surface of unconsolidated surficial deposits presented in Figures 1-1 and 1-2. When the building is demolished, the water table will equilibrate inside the bottom of the building (assuming that the drain becomes inoperable) which could potentially mobilize contaminants into the groundwater regime.

1.2.2 Building 776/777

The building 776/777 complex is located in the PA, between Eighth and Ninth Streets, just north of Building 707. Buildings 776 and 777 share a common wall, utilities, and maintenance. All floors in the building are reinforced concrete slabs. The main floor has an area of 135,000 square feet. Metal processing facilities occupy 62,000 square feet and waste handling occupies 63,000 square feet. The second floor contains 88,000 square feet and is almost entirely occupied by utilities. There are two sub-basement areas: a four bay area of approximately 1,600 square feet and an elevator pit area which is adjacent to the tunnel connecting Buildings 776 and 771. Figure 1-1 presents a site location map of the Building 776/777 complex and surrounding area.

Building 776/777 began operations in 1957 and has undergone several major production changes since then. Beginning in 1958 and continuing through 1969, Building 776 was the main manufacturing facility for plutonium weapons components and housed a plutonium foundry and fabrication operations. The main function of Building 777 was assembly of parts. After the Building 776/777 fire in 1969, the majority of the foundry and fabrication operations were transferred to Building 707. Limited production operations were resumed in Building 776/777 several months after the fire; however, the main focus of the building moved towards waste and residue handling, disassembly of site returns, and special projects. Processes included waste size reduction, pyrochemistry, coatings operations, machining, and product assembly and disassembly, including testing and inspection. Post-1989 production curtailment activities included waste handling and maintenance activities in Building 776, and a tritium surveillance laboratory and container repackaging operations in Building 777. In addition, nuclear material and waste are currently being stored in the building (DOE 1994a).

Eight PACs associated with Building 776/777 are listed in the RFETS HRR (DOE 1992b). The PACs were established as a result of documented spill incidents. Only PACs that are pertinent to this investigation, which means that they are located in Building 776/777 or immediately adjacent to the building, are discussed in Section 1.2.6, Potential Areas of Concern.The following process wastes have been generated by activities conducted in Building 776/777:

- Acids: nitric acid;
- Solvents: isopropyl and ethyl alcohol, TCE, TCA, tetrachloroethylene (PCE), carbon tetrachloride, acetone;
- Metals: chromium, copper, silver, beryllium, aluminum;
- Radionuclides: plutonium, americium, uranium, tritium and;
- Others: various oils (cutting, coolant, vacuum pump) Freon 113, Freon 12

Of the above listed potential contaminants, the most abundant associated with Building 776/777 are plutonium, americium, uranium isotopes, nitric acid, chlorinated solvents, and chromium.

Building 776/777 is currently considered to be a high hazard facility because of the large amounts of plutonium and uranium metal, oxides and residues stored in the building. In addition, the building houses a chemical material inventory typical of an industrial metal processing facility. This includes solvents (halogenated and non-halogenated), corrosives, oils and lubricants, and laboratory reagents and standards. Soil contamination underneath the building is expected from sources including seepage, through the concrete floor, of water used to control and extinguish the 1969 fire; and burial of at least three pieces of contaminated equipment in a heavy machinery pit below the basement floor of the building. The machinery was encapsulated in concrete at burial depths as great as 35 feet (DOE 1994a).

Based on a review of available site literature, it appears that there is no foundation drain beneath Building 776/777. There are references to a foundation drain, but no evidence of one has been found. Seasonal fluctuations in groundwater result in seepage of groundwater into at least one contaminated metal press pit and one sub-basement within this building complex (DOE 1994a). When the buildings are demolished, the water table will equilibrate inside the bottom of the buildings, if it has not already, which could potentially mobilize contaminants into the groundwater regime.

1.2.3 Building 371/374

The Building 371/374 complex is located in the northwestern portion of the PA at RFETS. The building is a four level, partially buried, structure constructed of reinforced concrete. It contains approximately 186,000 square feet of floor space. The building contains a basement floor and a sub-basement floor beneath the ground floor. Building 371 contains a glovebox system, a large central storage area, office areas, maintenance shops, and outside loading docks. Building 374 contains office space and liquid waste processing facilities. Figure 1-3 presents a site location map of the Building 371/374 complex and surrounding area.

Building 371 was originally built to assume the plutonium recovery operations of Buildings 771 and 776 using advanced technology for plutonium handling, recovery, and safety. The projected operations for the building focused primarily on the recovery of plutonium from both solid and liquid wastes. Pilot scale recovery operations began in 1981 and continued until the mid-1980s when serious design and construction deficiencies were identified (DOE 1994a). The last recovery operations in the facility were terminated in 1986. Since that time, operations in Building 371 have focussed mainly on waste and Special Nuclear Material (SNM) handling and storage and laboratory operations. Building 374 was constructed for the purpose of handling process waste generated in Building 371 and high level waste from Building 771. It began waste treatment operations in 1978 and began handling radioactive wastes from Building 371 in 1980 (DOE 1994a). Building 374 has successfully operated since that time.

The majority of Building 371 is used for handling and storing SNM and wastes. Wastes stored in the building may be categorized as transuranic waste, transuranic mixed waste, low level waste, and low level mixed waste (DOE 1994a).

Ten PACs associated with Building 371/374 are listed in the RFETS HRR (DOE 1992b). The PACs were established as the result of documented spill incidents. Only PACs that are pertinent to this investigation, which means that they are located in Building 371/374 or immediately adjacent to the building, are discussed in Section 1.2.6, Potential Areas of Concern.

The following process wastes have been generated by activities conducted in Building 371/374:

- Acids: nitric acid, hydrochloric acid, hydrofluoric acid;
- Bases: potassium hydroxide, sodium hydroxide;
- Solvents: carbon tetrachloride, TCA, toluene, chloroform, cyclohexane, ethylene glycol;
- Metals: beryllium;
- Radionuclides: plutonium, americium, uranium oxide; and

- Others: acidic plutonium nitrate solution, ammonium nitrate, cutting oil, engine oil

Of the above listed potential contaminants, the most abundant associated with Building 371/374 are plutonium, americium, nitric acid, and chlorinated solvents.

The contamination status of the Building 371/374 complex is such that close to 50 percent of the B371 process area requires respiratory protection for access. After the cessation of aqueous processing operations, attempts were made to quantify the amount of plutonium remaining in the process equipment, piping, tanks, canyons (areas originally designed to support SNM material processing; now storage areas), and floors. Approximately 50 percent of the plutonium processing area is expected to be radioactively contaminated. Areas used for storage of radioactive wastes may also be contaminated (DOE 1994a).

A complex foundation drain system is present beneath Building 371/374. The system operates by gravity flow. The perimeter portion of the drain is located at an approximate elevation of 5984 feet above msl. The inner, deeper, portion of the drain is located at an approximate elevation of 5967 feet above msl. The drain system impacts the localized water table in the immediate vicinity of Building 371/374, and creates convergence towards the building from all directions while the drains are in operation. The vicinity of Building 371/374 acts effectively as a groundwater sink as shown on Figure 1-3. When the building is demolished, and the drain system is potentially inoperable, the water table will equilibrate inside the bottom of the building. This could potentially mobilize contaminants into the groundwater regime.

1.2.4 Building 865

Building 865 is located immediately south of Central Avenue and east of Eighth Street in the south central portion of RFETS. The building is due south and across Central Avenue from the Portal 1 entrance to the PA. The southwest corner of Building 865 is approximately 100 feet due east of the northeast corner of Building 883. Figure 1-4 presents a site location map of Building 865 and the surrounding area.

Building 865 was placed into service in 1972. This building was used for material processing and development work that included fabrication, processing, and testing of metal parts. Depleted uranium and beryllium were processed in this building (DOE 1992b). Beryllium powder was mixed with other metals, placed in molds, and compressed into shapes. In addition, from 1983 through 1986, ultra pure beryllium metal was produced electrolytically (Chemrisk 1992). There is little available literature regarding the historic configuration of the building or the description and time line of historical operations at this building.

Four PACs associated with Building 865 are listed in the RFETS HRR (DOE 1992b). The PACs were established as the result of documented spill incidents. Only PACs that are pertinent to this investigation, which means that they are located in Building 865 or immediately adjacent to the building, are discussed in Section 1.2.6, Potential Areas of Concern.

The following process wastes have been generated by activities conducted in Building 865:

- Acids: nitric acid;
- Bases: unspecified bases;
- Solvents: chlorinated solvents (unspecified);
- Metals: beryllium, chromium, nickel, lead, copper, tungsten;
- Radionuclides: uranium isotopes; and
- Others: volatile organic compounds (unspecified), potassium dichromate

Of the above listed potential contaminants, the most abundant associated with Building 865 are uranium isotopes, beryllium, and nitric acid.

The contamination status of Building 865 is unknown at this time. However, based on interviews with site personnel, evidence for contaminant spills within the building that could impact groundwater appears to be minor.

A gravity flow foundation drain system is present in the south-central portion of Building 865. The drain is located at an approximate elevation of 5988 feet above msl, which does not appear to impact the localized water table in the immediate vicinity of Building 865, and causes redirection of potentiometric contour lines as shown in Figures 1-2 and 1-4. When the building is demolished, and the drain system is potentially inoperable, the water table will equilibrate inside the bottom of the building. This could potentially mobilize contaminants into the groundwater regime.

1.2.5 Building 883

Building 883 is located in the southeast corner of the intersection of Central Avenue and Eighth Street, outside the PA, in the south central portion of RFETS. The northeast corner of Building 883 is approximately 100 feet due west of the southwest corner of Building 865. Figure 1-4 presents a site location map of Building 883 and the surrounding area.

Building 883 is a two story, steel framed building which is connected to Building 881 (located 150 feet due south) by a tunnel. The tunnel connects the northwest corner of the second floor of Building 881 to the southwest corner basement of Building 883. Building 883 has a partial basement containing approximately 7,600 square feet, and a small second floor on the north and south ends. The building consists of 76,500 square feet of space, most of which is taken up by a high bay metal working facility containing large equipment (DOE 1994a).

Building 883 was put into service in 1957. At that time there were two parallel uranium fabrication operations that involved the use of presses, rolling mills and annealing furnaces. One operation was for enriched uranium fabrication and the other was for depleted uranium fabrication. The enriched uranium work was discontinued in the mid 1960s. In addition, beryllium ingots were also rolled into sheet material and etched in this building. Beryllium machining occurred in this building from the mid 1960s through the mid 1970s. Later, Building 883 served as a metals preparation area where parts were cleaned, rolled, formed, swaged, sheared, bent, and grit blasted before they were further used by other machining and production processes at various locations at the plant (DOE 1992b). A major addition to Building 883 was completed in 1985 to support manufacturing of armor plates containing depleted uranium for the M1A1 tank (DOE 1994a).

Eight PACs associated with Building 883 are listed in the RFETS HRR (DOE 1992b). The PACs were established as the result of documented spill incidents. Only PACs that are pertinent to this investigation, which means that they are located in Building 883 or immediately adjacent to the building, are discussed in Section 1.2.6, Potential Areas of Concern.

The following process wastes have been generated by activities conducted in Building 883:

- Acids: nitric acid, hydrofluoric acid;
- Solvents: TCE, PCE, TCA, other unspecified solvents, ethylene glycol;
- Metals: beryllium, aluminum, titanium, tungsten, vanadium, cadmium;
- Radionuclides: uranium isotopes; and
- Others: various oils, PCBs, Freon (compound unspecified), paints

Of the above listed potential contaminants, the most abundant associated with Building 883 are uranium isotopes, beryllium, and nitric acid.

The contamination status of Building 883 is vague. Since beryllium operations ceased in the mid 1980s, the building has undergone extensive decontamination (Chemrisk 1992). No additional information is available in Site literature regarding the contamination status of Building 883. However, based on interviews with site personnel, contamination appears to be minor.

A foundation drain system is present beneath Building 883. Intercepted groundwater flowed by gravity to a collection sump beneath the southwest portion of the building and was then pumped up to a storm sewer which daylighted to surface water. Based on discussions with building personnel, the sump that holds water from the foundation drain is no longer pumped. The drain is located at an approximate elevation of 5981 feet above msl, which may impact the localized water table in the immediate vicinity of Building 883, and create a slight redirection of potentiometric contour lines as shown in Figures 1-2 and 1-4. When the building is demolished, the water table will equilibrate inside the bottom of the building if it has not already. This could potentially mobilize contaminants into the groundwater regime.

1.2.6 Potential Areas of Concern

All of the PACs for the buildings covered by this SAP were reviewed. PACs are only discussed in this section if they are located in the building being described or immediately adjacent to the building. The PACs are not used to locate D&D monitoring wells but for the identification of contaminants of concern for the D&D baseline and post D&D groundwater monitoring.

1.2.6.1 Pertinent Building 707 PACs

PAC 700-185, Solvent Spill

In November 1986, the fork of a forklift punctured a 55-gallon drum of TCA on the southeast dock of Building 707. Approximately four gallons of the solvent spilled on the ground. Material was cleaned up and placed in drums by the Fire Department and taken to Hazardous Storage. No documentation was found which detailed the fate of the spilled solvent (DOE 1992b).

PAC 700-1103, Leaking Transformers-Building 707

Transformers 707-1 through 707-6 are located on the southeast quarter of the Building 707 roof. Concrete under the transformer drain valves was observed to be contaminated with polychlorinated biphenyls (PCBs) in November 1986. In 1987, a leak was discovered from Transformer 707-1 during routine maintenance. Visible evidence of leaks was discovered at the valve area and weld seams. Soil analyses and swipe samples confirmed that the pad on the roof and soil on the ground immediately east of the building was contaminated with PCBs. The soil was contaminated by a downspout that delivered rainwater from the roof to the ground (DOE 1992b). Approximately 65 cubic yards of contaminated soil was removed from the site.

1.2.6.2 Pertinent Building 776/777 PAC

PAC 700-131, Radioactive Site-700 Area Site #1

As a result of a June 1964 explosion in Building 776, an area of approximately 1,500 square feet of soil at the exit of the gas bottle dock became contaminated with plutonium. An additional area of 2,000 square feet at the west end of the north side of Building 776 was contaminated by radioactivity during the course of firefighting activity in May 1969. Plutonium tracked outside of the building by firefighting and support personnel was detectable on the ground around the building. In each instance, contaminated soil was removed. No documentation was found which detailed the fate of the constituents from both the 1964 explosion and the 1969 fire(DOE 1992b).

1.2.6.3 Pertinent Building 371/374 PACs

PAC 300-198, Acid Leak

Sometime during 1983, a drum containing a mixture of nitric acid and hydrochloric acid leaked its contents onto unpaved ground near the dock located in the southwest corner where Buildings 371 and 374 intersect. The maximum amount of the spill would have been 55 gallons. It is likely that the mixture was a waste metal leaching solution that might have contained some heavy metals. No documentation was found which detailed a response to this occurrence. According to the Comprehensive Environmental Assessment and Response Program (CEARP) Phase 1 document, no environmental hazard should remain (DOE 1992b).

PAC 300-212, Building 371 Drum Storage, Unit 63

Unit 63 is located in Room 3420 of Building 371 and is used to store transuranic (TRU) mixed solid waste. No processing is allowed in Room 3420 and the maximum allowed number of stored drums is 668. Drums are brought to Building 371 from various sources on the plant and stored in Room 3420 pending staging and ultimate shipment to a disposal facility. The waste includes transuranic waste, solvents, and VOCs (DOE 1992b). No documentation was found which details a release associated with this drum storage area.

1.2.6.4 Pertinent Building 865 PAC

PAC 800-179, Building 865 Drum Storage Area

The Building 865 Drum Storage Area was first used in 1970 and is currently used as a RCRA 90-day accumulation area. The storage area is in Room 145 and measures 12 feet by 8 feet. Drums stored there contain VOCs, beryllium, and radioactive waste. In the past, chlorinated solvents were also stored there. There have been no documented releases and based on a visual inspection conducted in November 1986, there was no visual evidence of spills (DOE 1992b).

1.2.6.5 Pertinent Building 883 PACs

PAC 800-180, Building 883 Drum Storage Area

The Building 883 Drum Storage Area was first used in 1981 and is currently used as a RCRA 90-day accumulation area. The storage area is in Room 104 and measures 16 feet by 10 feet. Drums stored there contain waste oils that are generally contaminated with solvents and uranium. Analytical results have indicated the presence of VOCs, beryllium, and radioactivity. There have been no documented releases and based on a visual inspection in November 1986, there was no evidence of spills or leakage (DOE 1992b).

PAC 800-1206, Fire, Building 883

In October 1982, a contaminated trash fire occurred in Building 883. The fire was associated with grinding operations. Maintenance personnel placed the container outside the building. The fire department responded and spread the contents on the ground. No documentation was found that detailed what constituents were released or the fate of constituents released to the environment.

PAC 800-1207, Transformer 883-4

Transformer 883-4 is located at the southeast corner of Building 883. The transformer was inspected in 1985 and was found to have leaked. Transformer 883-4 was found to contain greater than 500 ppm PCBs. The original transformer pad was partially removed to make room for a new pad. The area drains to an access road approximately six feet from the original pad. There was no information to indicate that the spill drained to the access road.

1.3 Hydrogeologic Setting

All of the site buildings addressed in this SAP are situated on a gently eastward sloping topographic and bedrock pediment surface mantled by unconsolidated Rocky Flats Alluvium, and underlain mainly by claystones and siltstones of the Cretaceous Laramie Formation (EG&G, 1995a). Several monitoring wells installed north of Building 776/777, as part of the IHSS 118.1 study, have encountered sands typical of the Cretaceous Arapahoe Formation.

1.3.1 Building 707

The thickness of the alluvium at Building 707 ranges from about 6 feet at well P218089, located immediately east of the building; to about 7 feet at well 60399, located at the northwest corner of the building; to about 2.3 feet at well 60699, located approximately 70 feet west/southwest of the southwest corner of the building. The depth to groundwater (most recent data available for a given well) ranged from 6.2 feet below ground surface (bgs) at P218089 and 60399, to 7.1 feet bgs at 60699, resulting in an alluvial saturated thickness of less than one foot, if any. Based on these data, the alluvial saturated thickness in this portion of the site is very thin. At certain times of the year Upper Hydrostratigraphic Unit (UHSU) groundwater flow may be in the weathered bedrock. Historical water level fluctuations have been as much as 4.2 feet for well P218089. The closest currently active and potentially upgradient wells to Building 707 are wells 60499 and 60599, located approximately 100 feet to the west of Building 707. These wells are suitable for sampling as upgradient wells. Well P218089 is the closest downgradient well and will be utilized for D&D sampling. Figure 1-1 illustrates the location of existing monitoring wells found in the Building 707 area.

Detailed analysis of groundwater flow patterns in the vicinity of Building 707 is prohibited by a lack of sufficient well control near the building. According to recent, previous interpretations (RMRS 1999b, Plate 2), groundwater at Building 707 is expected to flow in an east/northeast direction with a horizontal hydraulic gradient of about 0.008 ft/ft in the vicinity of the building. Figure 1-1 presents localized potentometric contours. Figure 1-2 illustrates the site wide potentiometric contours from 2nd quarter 1998 data (RMRS 1999b, Plate 2). Available data indicate a broad, northeast trending, area of relatively flat groundwater gradient dominates the flow field in this region of the Industrial Area (IA), and may be influenced by anthropogenic features such as the Building 700 complex. The potentiometric maps referenced above account for potential flow perturbations caused by foundation drains. Building 707 was constructed with a foundation drain that, in general, does not influence potentiometric contours in the vicinity of the building.

The presence of subsurface barriers or sinks, such as building basements, foundation drains, deep storm drains, excavations, and buried utility corridors can locally alter groundwater flow directions and lead to containment or spreading of contaminant plumes. The effect of artificial features on the water table is expected to be greatest during spring when water levels reach seasonal highs and interact more extensively with the subsurface drainage structures. These structures are assumed to affect shallow groundwater flow only during brief, high water level periods associated with a spring recharge event.

Based on flow path analysis of potentiometric data, the nearest receiving stream for groundwater originating at Building 707 is South Walnut Creek, located approximately 800 feet to the east. Groundwater flows through the Rocky Flats Alluvium and potentially through weathered bedrock to South Walnut Creek. The groundwater flow velocities for conservative (non-reactive) constituents are estimated at 17.4 feet/year (ft/yr), assuming a geometric mean hydraulic conductivity for the Rocky Flats Alluvium of 2.1×10^{-4} centimeters/second (cm/sec) (EG&G, 1995b, Table G-2), an effective porosity of 0.1, and the hydraulic gradient value given above. This velocity translates to a minimum contaminant travel time from Building 707 to surface water of approximately 46 years. The travel time through weathered bedrock would be greater. Actual contaminant travel times can be expected to be much longer for highly retarded contaminants such as plutonium and americium, and slightly longer for weakly retarded contaminants, such as VOCs and some metals.

The existing groundwater quality beneath Building 707 and along the flow path towards South Walnut Creek is generally not impacted by contaminants. The northwest corner of the building brushes the eastern edge of the East Industrial Area Plume (VOCs). Nitrates and radiological contamination does not appear to be significant along the groundwater flow path from Building 707 to South Walnut Creek (RMRS, 1999). Building 707 foundation drain chemical data is generally not available after 1995. Samples collected before 1995 suggest that groundwater collected by the drain contained some minor contamination with a few, random higher values scattered throughout the data. The majority of this data was not validated. The results of all these data are non-detect based on the detection limits existing at that time.

1.3.2 Building 776/777

The thickness of the alluvium at Building 776/777 ranges from about 10.2 feet bgs at well 02397, located at the southeast corner of the building; to about 7.7 feet bgs at well 60299, located at the southwest corner of the building; to about 9 feet at well 60099, located at the northwest corner of the building. The depth to groundwater (most recent data available for a given well) ranged from 10.1 feet at 02397, to 8.7 feet at 60299, to dry at 60099. Based on these data, there is a very thin to non-existent alluvial saturated thickness in this portion of the site. At certain times of the year, UHSU flow may be in the weathered bedrock. Historical water level fluctuations have been as much as 2.3 feet for well 02397. The closest currently active and potentially upgradient well to Building 776/777 is well 22896, located approximately 200 feet due west of the southwest corner of Building 776/777. This well is not suitable for sampling as an upgradient well because of its proximity and potentially upgradient location to Building 566. Monitoring well 23895, located approximately 50 feet north of the northeast corner of Building 777, is the closest downgradient well but is of unsuitable construction to be utilized for D&D sampling. Figure 1-1 illustrates the location of existing monitoring wells found in the Building 776/777 area.

Detailed analysis of groundwater flow patterns in the vicinity of Building 776/777 is prohibited by a lack of sufficient well control near the building. According to recent, previous interpretations (RMRS 1999, Plate 2), groundwater at Building 776/777 is expected to flow predominantly in a northeast direction with a horizontal hydraulic gradient of about 0.0115 ft/ft in the vicinity of the building. Figure 1-1 presents localized potentiometric contours. Figure 1-2 illustrates the site wide potentiometric contours from 2nd quarter 1998 data (RMRS 1999, Plate 2). A broad, northeast trending, area of relatively flat groundwater gradient dominates the flow field in this region of the Industrial Area (IA), and may be influenced by anthropogenic features such as the Building 700 complex. The potentiometric maps referenced above account for potential flow perturbations caused by foundation drains. Based on available information, we cannot ascertain if Building 776/777 was constructed with a foundation drain.

Based on flow path analysis of potentiometric data, the nearest receiving stream for groundwater originating at Building 776/777 is North Walnut Creek, located approximately 1200 feet to the northeast. Groundwater flows through the Rocky Flats Alluvium and potentially through weathered bedrock to North Walnut Creek. The groundwater flow velocities for conservative (non-reactive) constituents are estimated at 25 ft/yr, assuming a geometric mean hydraulic conductivity for the Rocky Flats Alluvium of 2.1×10^{-4} cm/sec (EG&G, 1995b, Table G-2), an effective porosity of 0.1, and the hydraulic gradient value given above. This velocity translates to a minimum contaminant travel time from Building 776/777 to surface water of approximately 60 years. The travel time through weathered bedrock would be greater. Actual contaminant travel times can be expected to be much longer for highly retarded contaminants such as plutonium, americium, and cesium, and slightly longer for weakly retarded contaminants, such as VOCs and some metals.

The existing groundwater quality in the vicinity of Building 776/777 is impacted by contaminants. The East Industrial Area Plume (VOCs) is found on the south and west sides of Building 776. The IHSS 118.1 plume occurs due the north of Building 776 and 777. Along the flow path towards North Walnut Creek groundwater emanating from the site will pass through the northern extent of the IHSS 118.1 Plume, including a portion that is 100 times the MCL for VOCs. Nitrates and uranium contamination associated with the Solar Ponds Plume does not appear to be adjacent to Building 776/777 but the flowpath of potential contamination from these buildings could go through this area to North Walnut Creek (RMRS, 1999).

1.3.3 Building 371/374

The thickness of the alluvium at Building 371/374 is an estimation because the closest existing monitoring wells are approximately 200 feet from the building. Alluvial thickness at these wells ranges from about 16.4 feet at well P119389, located 170 feet southwest of the building; to about 26.5 feet at well 22596, located 210 feet north of the northeast corner of the building; to about 15 feet at well 2186, located 230 feet north of the building. The depth to groundwater (most recent data available for a given well) ranged from 5.4 feet bgs at P119389, to 23.6 feet bgs at 22596, resulting in an alluvial saturated thickness of 3 to 11 feet. (Monitoring well 2186 is a bedrock well and, as such, was not included in the discussion of alluvial saturated thickness.) Historical water level fluctuations have been as much as 12.7 feet for well P119389, and 3.3 feet for well 22596. The closest currently active and potentially upgradient well to Building 371/374 is well P119389. This well may be suitable for sampling as an upgradient well because there are no upgradient plant site features between the well and Building 371/374. Well 22596 is the closest downgradient well and will not be used for D&D sampling because of its distance from Building 371/374 and because it is potentially downgradient of Building 373. Figure 1-3 illustrates the location of existing monitoring wells found in the Building 371/374 area.

Detailed analysis of groundwater flow patterns in the vicinity of Building 371/374 is prohibited by a lack of sufficient well control near the building. According to recent, previous interpretations (RMRS 1999, Plate 2), groundwater in the vicinity of Building 371/374 is expected to flow in a northeasterly direction with a horizontal hydraulic gradient of about 0.014 ft/ft. Figure 1-3 presents localized potentiometric contours. Figure 1-2 illustrates the site wide potentiometric contours from 2nd quarter 1998 data (RMRS 1999, Plate 2). As discussed above, the complex foundation drain beneath Building 371/374 creates an area of groundwater convergence, in the immediate vicinity of the building, towards the building. The potentiometric maps referenced above account for potential flow perturbations caused by foundation drains. The presence of subsurface barriers or sinks, such as building basements, foundation drains, deep storm drains, excavations, and buried utility corridors can locally alter groundwater flow directions and lead to containment or spreading of contaminant plumes.

Based on flow path analysis of potentiometric data, and if the foundation drains at Building 371/374 are inoperable (post-D&D), the nearest receiving stream for groundwater originating at Building 371/374 is North Walnut Creek, located approximately 500 feet to the north. Groundwater flows through the Rocky Flats Alluvium to North Walnut Creek. The groundwater flow velocities for conservative (non-reactive) constituents are estimated at 30.4 ft/yr, assuming a geometric mean hydraulic conductivity for the Rocky Flats Alluvium of 2.1×10^{-4} cm/sec (EG&G, 1995b, Table G-2), an effective porosity of 0.1, and the

hydraulic gradient value given above. This velocity translates to a minimum contaminant travel time from Building 371/374 to surface water of approximately 16.5 years. Actual contaminant travel times can be expected to be much longer for highly retarded contaminants such as plutonium, americium, and cesium, and slightly longer for weakly retarded contaminants, such as VOCs and some metals. Given the current situation at Building 371/374, with the foundation drains in operation, groundwater flow discharges to the unnamed tributary creek just east of the building. The travel time to the unnamed tributary creek is probably on the order of a day.

The existing groundwater quality beneath Building 371/374 and along the flow path towards North Walnut Creek is generally not impacted by nitrates, VOCs, or radiological contamination (RMRS, 1999). The closest contamination is the northwest edge of the IA VOC Plume located just southeast of Building 371/374. Building 371/374 foundation drain chemical data is generally not available after 1995. Samples collected before 1995 suggest that groundwater collected by the drain contained some minor contamination with a few, random higher values scattered throughout the data. The majority of this data was not validated. The results of all these data are non-detect based on the detection limits existing at that time.

1.3.4 Buildings 865 and 883

The hydrogeologic setting of Buildings 865 and 883 will be discussed together because of their proximity. The thickness of the alluvium at Buildings 865 and 883 ranges from about 11.5 feet at well 6186, located in the southeast corner of the intersection of Central Avenue and Eighth Street; to about 20 feet at well 37791, located about 100 feet south of Building 883; to about 6.4 feet at well P317989, located approximately 40 feet southeast of the southeast corner of Building 865. The depth to groundwater (most recent data available for a given well) ranged from 9.9 feet bgs at 6186, to 19.3 feet bgs at 37791, to 7.4 feet bgs at P317989, resulting in an alluvial saturated thickness of 0 to 1.6 feet. Based on these data, there is a very thin to non-existent alluvial saturated thickness in this portion of RFETS. This indicates that UHSU flow may be through weathered bedrock for some portion of the year. Historical water level fluctuations have been as much as 3.9 feet for well 6186; 2.5 feet for well 37791; and 3.8 feet for well P317989. The closest currently active and potentially upgradient well to Building 865 is well 6186, located approximately 400 feet northwest of the building. These wells are not suitable for sampling as an upgradient D&D well because of its distance from Building 865. Monitoring wells P317989 and 40999 are existing, potentially downgradient, wells in the vicinity of Building 865. These wells are downgradient of Building 865 and are suitable for D&D monitoring. The closest currently active and potentially upgradient well to Building 883 is 61199, which is located approximately 50 feet

west of Building 883. This well is suitable for sampling as an upgradient D&D well because there are not any nearby upgradient plant site features between the well and Building 883 that would affect upgradient groundwater quality. There are no downgradient wells in the vicinity of Building 883. Figure 1-4 illustrates the location of existing monitoring wells found in the vicinity of Buildings 865 and 883.

Detailed analysis of groundwater flow patterns in the vicinity of Buildings 865 and 883 is complicated by a lack of sufficient well control near the buildings and the potentially divergent nature of the flow field in this portion of the site. According to recent, previous interpretations (RMRS 1999, Plate 2), groundwater at Building 865 is expected to flow in a southeast direction with an average horizontal hydraulic gradient of 0.0675 ft/ft, while groundwater at Building 883 is expected to flow in a south to southeast direction with a an average horizontal hydraulic gradient of 0.086 ft/ft. Figure 1-4 presents localized potentiometric contours. Figure 1-2 illustrates the site wide potentiometric contours from 2nd quarter 1998 data (RMRS 1999, Plate 2). A broad, east-west trending, ridge like pattern dominates the flow field in this region of the Industrial Area (IA), which creates a poorly defined groundwater divide in the area of Building 865. This feature appears to exist mainly as a result of natural topographic and geologic controls, and may be influenced by anthropogenic features such as the Building 800 complex. This feature may also provide a mechanism for a small component of flow from Building 865 to the northeast. The potentiometric maps referenced above account for potential flow perturbations caused by foundation drains. Buildings 865 and 883 were constructed with foundation drains that, in general, moderately influence potentiometric contours in the vicinity of the buildings. The foundation drains for Building 881, located approximately 100 feet south of Building 883, appear to have a much greater affect on the local water table than the foundation drains beneath Buildings 865 and 883.

The presence of subsurface barriers or sinks, such as building basements, foundation drains, deep storm drains, excavations, and buried utility corridors can locally alter groundwater flow directions and lead to containment or spreading of contaminant plumes. The effect of artificial features on the water table is expected to be greatest during spring when water levels reach seasonal highs and interact more extensively with the subsurface drainage structures. These structures are assumed to affect shallow groundwater flow only during brief, high water level periods associated with a spring recharge event.

Based on flow path analysis of potentiometric data, the nearest receiving stream for groundwater originating at Building 865 is Woman Creek, located approximately 1,700 feet to the southeast. A small component of groundwater flow from Building 865 may flow towards South Walnut Creek, located approximately 1,400 feet to the northeast. Groundwater flows through the Rocky Flats Alluvium and potentially through weathered bedrock from Building 865 to Woman Creek and possibly to South Walnut

Creek. The groundwater flow velocity for conservative (non-reactive) constituents is estimated at 187 ft/yr, assuming a geometric mean hydraulic conductivity for the Rocky Flats Alluvium of 2.1 x 10^{-4} cm/sec (EG&G, 1995b, Table G-2), an effective porosity of 0.1, and the hydraulic gradient value given above. This velocity translates to a minimum contaminant travel time from Building 865 to Woman Creek of approximately 9 years. We believe that the major flux of groundwater from the Building 865 area flows southeast. If a small component of groundwater emanating from beneath Building 865 does flow to the northeast towards South Walnut Creek, the flow velocity, using the parameters listed above and an average hydraulic gradient value along the flow path of 0.035 ft/ft, is estimated at 76 ft/yr. This velocity translates to a minimum contaminant travel time from Building 865 to North Walnut Creek of approximately 18 years. Travel time through weathered bedrock will be slower. Actual contaminant travel times can be expected to be slightly longer for weakly retarded contaminants, such as VOCs, uranium, and some metals.

Based on flow path analysis of potentiometric data, the nearest receiving stream for groundwater originating at Building 883 is Woman Creek, located approximately 1,600 feet to the south. Groundwater flows through the Rocky Flats Alluvium and potentially through weathered bedrock from Building 883 to Woman Creek. The groundwater flow velocities for conservative (non-reactive) constituents are estimated at 147 ft/yr, assuming a geometric mean hydraulic conductivity for the Rocky Flats Alluvium of 2.1 x 10^{-4} cm/sec (EG&G, 1995b, Table G-2), an effective porosity of 0.1, and the hydraulic gradient value given above. This velocity translates to a minimum contaminant travel time from Building 883 to surface water of approximately 11 years. The travel time through weathered bedrock will be slower. Actual contaminant travel times can be expected to be slightly longer for weakly retarded contaminants, such as VOCs, uranium, and some metals. It is possible that some component of groundwater flow collected from the Building 883 foundation drain is routed through the Building 881 foundation drain, as they are potentially connected. The Building 881 foundation drain outfall is located on the hillside south of Building 881. This water would have a shorter travel time to surface water.

Nitrates or VOC contamination are not known to impact the existing groundwater quality beneath Buildings 865 and 883 along the flow path towards Woman Creek. Radiological contamination may be present south and southeast of Building 883 along the flow path from both buildings to Woman Creek (RMRS, 1997). Building 865 and 883 foundation drain chemical data is generally not available after 1995. Samples collected before 1995 suggest that groundwater collected by each building's drains contained some minor contamination with a few, random higher values scattered throughout the data. The majority of this data was not validated. The results of the Building 883 data were all non-detect based on the detection limits existing at that time. The Building 865 foundation drain data showed a few results for cadmium and lead over the Tier II Action Levels.

2.0 SAMPLING RATIONALE

Historical information detailed in Section 1.2 provides general indications of the types of compounds anticipated at each building area, and was used to develop a systematic sampling strategy for these investigations. The sampling rationale also accounts for the presumed direction of groundwater flow evaluated for each building area in Section 1.3 and the need for establishing background (upgradient) groundwater quality benchmarks for selected contaminants-of-concern. Monitoring well locations have been selected along groundwater flow paths associated with contaminant release areas for each building. Groundwater sampling will be restricted to new monitoring wells installed at Buildings 707, 776/777, 371/374, 865, 883 and samples from designated existing wells (as described in Section 4.1) to be used for D&D monitoring. Water levels in the immediate vicinity of the individual areas will be collected once to strengthen groundwater flow and quality interpretations. Additional existing wells for initial water level measurements are listed in Section 4.5. In addition, foundation drain outfalls, where appropriate, will be sampled. The outfall locations are identified in Section 4.1.

The following conditions were considered in the development of the sampling strategy:

- The operating history of Building 707 indicates that volatile organic, metals, and radiological contaminants could be released to the environment from surface and subsurface sources during D&D;
- The operating history of Building 776/777 indicates that volatile organic, metals, and radiological contaminants could be released to the environment from surface and subsurface sources during D&D;
- The operating history of Building 371/374 indicates that volatile organic, metals, radiological, nitrate, and acidic and caustic contaminants could be released to the environment from surface and subsurface sources during D&D;
- The operating history of Building 865 indicates that volatile organic, metals, uranium isotopes, nitrate, and caustic contaminants could be released to the environment from surface and subsurface sources during D&D;
- The operating history of Building 883 indicates that volatile organic, metals, uranium isotopes, nitrate, and acidic contaminants could be released to the environment from surface and subsurface sources during D&D;
- The physical and chemical properties of some of these contaminants suggest that they can be easily mobilized when released into the environment;
- Historical data indicate the presence of contaminants in quantities above the maximum background concentrations defined by Site Procedure 3-PRO-140-RSP-09.03, *Radiological Characterization of*

Bulk or Volume Solid Materials and the *Background Geochemical Characterization Report* (DOE 1993); and

- Subsurface Industrial Area structures and operations may cause local effects on groundwater flow direction and discharge that affect monitoring system design.

The conceptual model of contaminant migration to groundwater involves percolation of liquids and leaching of contaminants from surface soils and foundations and drains downward through the unsaturated zone to the water table, and leaching of contaminants from subsurface waste lines during high water table periods. After contaminants encounter the saturated zone, contaminant migration will proceed laterally and follow the principal direction of post-D&D groundwater flow. Groundwater at Building 707 is presumed to flow in an easterly direction. Groundwater at Building 776/777 is presumed to flow in a northeasterly direction. Groundwater at Building 371/374 is presumed to flow in a northeasterly direction. Groundwater at Building 865 is presumed to flow in a southeasterly direction with a possible northeastward component. Groundwater at Building 883 is presumed to flow in a southerly direction. These presumptions disregard the fact that for all buildings except 776/777, foundation drains capture some portion of the groundwater. Contaminant movement in the unsaturated and saturated zones may be retarded to various degrees by sorption, volatilization, or biodegradation, depending on the chemical behavior of the contaminant. Contaminant concentrations may also be reduced by dispersion during migration.

Paved portions of the Building 707, 371/374, and 883 areas, which encircle some of the buildings are expected to partially impede contaminant migration from the surface, as some precipitation and surface runoff is diverted to the storm water drainage system instead of percolating through the ground surface. Buildings 776/777 and 865 have a much lower percentage of immediately adjacent area that is effectively capped and, therefore, downward migration of contaminants in soils adjacent to the buildings is expected to be relatively unimpeded.

3.0 DATA QUALITY OBJECTIVES

The data quality objective (DQO) process consists of seven steps and is designed to be iterative; the outputs of one step may influence prior steps and cause them to be refined. Each of the seven steps are described below for the investigative areas presented in Figures 1-1, 1-3, and 1-4. Data requirements to support these investigations were developed and are implemented in the project using criteria established in *Guidance for the Data Quality Objective Process*, QA/G-4 (EPA 1994).

3.1 State the Problem

Previous investigations of the individual Sites have identified various types of contamination that have either been released to soils or leaked from tanks, various subsurface process lines, and/or sumps. The purpose of these investigations is to establish baseline hydrogeochemical conditions at each building prior to D&D activities, and to determine the presence or absence of potential hazardous and/or radioactive contamination located in groundwater downgradient of the buildings resulting from D&D activities.

3.2 Identify the Decision

Decisions required to be made using chemical and water level data collected from groundwater monitoring wells:

- Do contaminants of concern from the buildings have the potential to impact groundwater?
- Do D&D activities create an adverse impact to groundwater which can affect surface water quality? If yes, as per the IMP, are concentrations above the mean plus 2 standard deviations with respect to ambient (baseline) concentrations?
- Do water table elevations and resulting groundwater flow path interpretations reinforce the groundwater quality results?

3.3 Identify Inputs to the Decision

Inputs to the decision include radiochemical and chemical analytical results from groundwater samples collected from existing and newly installed monitoring wells utilized to establish a pre-D&D baseline. The parameters of interest include the analyses outlined in Table 4-7, *Analytical Requirements for Groundwater Samples.*

Further inputs to the decision include water level measurements from new and existing monitoring wells, which will be used to delineate groundwater flow directions for interpretation of groundwater analytical data. Land surveying of new well casing locations (± 1 foot) and elevations (± 0.01 foot) will be conducted as per RMRS/OPS-PRO.123, *Land Surveying,* to provide control for potentiometric contouring.

3.4 Define the Boundaries

The investigative boundaries and rationale are detailed in Section 4 of this SAP. Investigative boundaries coincide approximately with the perimeter depicted by existing and proposed D&D monitoring wells around the various buildings as shown on Figures 1-1, 1-3, and 1-4.

3.5 Decision Rule

If the radiochemical activities or chemical concentrations in the groundwater exceed the established baseline during or after D&D, an evaluation of potential impacts to surface water is required as well as notification of the appropriate parties as per the IMP. The fiscal year 2000 IMP contains a decision tree regarding building-specific D&D monitoring wells (page 3-28).

3.6 Limits on Decision Errors

Additional characterization, if required, will be based upon an evaluation of data collected under this SAP. An evaluation of an exceedance to the established baseline can be performed by laboratory data evaluation utilizing precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters and data validation. Data validation typically is performed on 25 percent of the laboratory analytical data. Well locations, as shown on Figures 1-1, 1-3, and 1-4, are based on previous hydrogeologic investigations, current-day field observations, interpretation of groundwater flow directions, and the location of contaminant releases, original process waste lines (OPWLs) and Resource Conservation and Recovery Act (RCRA) process lines. Groundwater monitoring will be performed in accordance with this SAP and the RFETS Integrated Monitoring Plan (DOE 1997).

3.7 Optimize the Design

In the event that further characterization is required to evaluate contaminant releases to groundwater from Buildings 707, 776/777, 371/374, 856 or 886, the results of the investigations described in this SAP will be used design additional field activities, such as selection of additional well locations and refinement of the analytical parameter suite. Additional phases of field activity will be implemented under a separate SAP or the IMP.

4.0 SAMPLING ACTIVITIES AND METHODOLOGY

4.1 Monitoring Well Locations and Numbering

4.1.1 Building 707

One new monitoring well location has been chosen to monitor groundwater quality associated with Building 707. The well, 00200, will be constructed east of the building to monitor downgradient groundwater quality. Existing monitoring wells 60499, 60599, 61499 and P218089 will also be utilized for D&D monitoring at Building 707. Wells 60499 and 60599 will be used to monitor upgradient water quality; wells 61499 and P218089 will monitor downgradient water quality. In addition to the above well locations, a water sample will be collected from a manhole, FD-707-4, which is located approximately 30 feet east of the southeast corner of Building 707. The manhole will be sampled because the Building 707 foundation drain, which operates by gravity flow, eventually discharges to surface water east of the 750 Pad at a location called GS40. The manhole isolates the portion of flow that emanates from the Building 707 foundation drain. Figure 1-1 illustrates the location of these wells, manhole FD-707-4, and GS40 in relation to Building 707 and surrounding features. The total number and arrangement of wells reflects the spatial complexity of potential contaminant releases at the building and unknowns regarding the configuration of the local groundwater flow field. Individual well locations were determined with respect to potential contaminant source areas (as reviewed in the HRR), and an assumed eastward groundwater flow direction. Well names (location codes) were assigned based on a five digit numbering system adopted by ER in 1992, with the year drilled indicated by the last two digits. The rationale for each new monitoring well location is summarized in Table 4-1.

Table 4-1 Building 707 Monitoring Well Location Rationale

Well Number	Location	Rationale
00200	East side of Building, just south of B731; field logistics will dictate exact location	Monitor water quality downgradient of basement
61499 (existing)	Northeast corner of Building	Monitor downgradient water quality
P218089 (existing)	East side of Building, southern half	Monitor water quality downgradient of basement
60499 (existing)	West side of Building, northern third	Monitor upgradient water quality
60599 (existing)	West side of Building, southern half	Monitor upgradient water quality

4.1.2 Building 776/777

Four new monitoring well locations have been chosen to monitor groundwater quality associated with Building 776/777. One well, 00400, will be constructed south of Building 776/777 to monitor upgradient groundwater quality. Two wells, 00600 and 00700, will be constructed north and one, 00500, constructed at the northeast corner of Building 776/777 to monitor downgradient groundwater quality. The concentration of buried utilities on the north and south sides of Building 776/777 will dictate the exact location of the new D&D wells. There is the possibility that no wells can be located north or south of Building 776/777 because of these utilities and proximity to other buildings and utilities north of Building 776/777. Existing monitoring well 60299 will be used to monitor water quality upgradient of Building

776/777. In addition, one new well, 00100, will be added to the D&D monitoring network northeast of the 779 foundation slab to monitor possible contaminant migration from the sub-basement of the building. Figure 1-1 illustrates the location of these wells in relation to Building 776/777 and surrounding features. The total number and arrangement of wells reflects the spatial distribution of potential contaminant releases at the building and uncertainty regarding unsaturated areas in the vicinity. Individual well locations were determined with respect to potential contaminant source areas (as reviewed in the HRR), and an assumed northerly groundwater flow direction. Well names were assigned based on the five digit numbering system adopted by ER in 1992. The rationale for each new monitoring well location is summarized in Table 4-2.

Table 4-2 Building 776/777 Monitoring Well Location Rationale

Well Number	Location	Rationale
00400	South side of Building 776/777, center; field logistics will dictate exact location	Monitor upgradient water quality, downgradient of B778
00500	East side of Building 777, center; field logistics will dictate exact location	Monitor water quality downgradient of B776/777 basement
00600	North side of Building 777, center	Monitor water quality downgradient of B776/777 basement
00700	North side of Building 776, center; field logistics will dictate exact location	Monitor water quality downgradient of B776 elevator pit and tunnel
60299 (existing)	Southwest corner of Building 776	Monitor upgradient water quality
00100	Southeast corner of Building 779	Monitor downgradient water quality from building sub-basement

4.1.3 Building 371/374

Six new monitoring well locations have been chosen to monitor groundwater quality associated with Building 371/374. Because the existing well coverage is extremely limited in the vicinity of the building, and because of the complexity of the foundation drain system, the wells are located in a circular pattern, generally equidistant, around the building, as shown on Figure 1-3. The concentration of buried utilities, especially at the northeast and southeast portions of the building, will dictate the exact location of the new D&D wells. The complex foundation drain at Building 371/374, which operates by gravity flow, effectively creates a groundwater sink in the immediate vicinity of the building. As such, the Building

371/374 D&D monitoring wells are located with regard to their post D&D effectiveness, assuming the drain becomes inoperable, and the groundwater flow patterns in the immediate vicinity of the building return to the expected, generally northeast, flow direction. Because this particular building foundation drain system has such a profound affect on the local water table, the new D&D monitoring wells may not be effective in constructing the building D&D baseline. In addition to the new monitoring well locations, water samples will be collected from each of two outfalls which emanate from the Building 371/374 foundation drain system. These two locations may be the most important sampling locations with respect to the Building 371/374 D&D baseline. The first outfall, from the elevation 5984 msl drain, is designated 371 Basement. The second outfall emanates from the elevation 5967 msl drain and is designated 371 Sub-Basement. The sampling locations for these foundation drain outfalls are shown on Figure 1-3. Building 371/374 monitoring well names were assigned based on the five digit numbering system adopted by ER in 1992. The rationale for each new monitoring well location is summarized in Table 4-3.

Table 4-3 Building 371/374 Monitoring Well Location Rationale

Well Number	Location	Rationale
00900	West side of Building 371, south of center	Monitor upgradient water quality
01000	South side of Building 371, center; field logistics will dictate exact location	Monitor upgradient water quality
01100	South side of Building 374, center; field logistics will dictate exact location	Monitor upgradient water quality
01200	North side of Building 374, center; field logistics will dictate exact location	Monitor water quality downgradient of caustic and acid bulk tanks, and B374 basement
01300	North side of Building 371, north of B381; field logistics will dictate exact location	Monitor water quality, downgradient of B381, and B371 sub-basement
01400	North side of Building 371, west of center	Monitor water quality downgradient of B371 sub-basement

4.1.4 Building 865

Three new monitoring well locations have been chosen to monitor groundwater quality associated with Building 865. One well, 01600, will be positioned centrally along the west side of the building to monitor upgradient groundwater quality, and another well, 01700, will be positioned at the northwest corner of the building to also monitor upgradient groundwater quality. The third well, 01800, will be located to monitor downgradient water quality at the south-central portion of the building. Existing wells 40999 and P317989 will be utilized to monitor downgradient water quality at Building 865. In addition to the new D&D monitoring wells, the Building 865 foundation drain, which operates by gravity flow, will be sampled by accessing manhole BS-865-2, located just south of the east side main building entrance. The manhole isolates the foundation drain flow before it merges with storm drain flow and daylights to the east between Buildings 865 and 886. Figure 1-4 illustrates the location of the new D&D wells, existing wells, and manhole BS-865-2 in relation to Building 865 and surrounding features. Individual well locations were determined with respect to potential contaminant source areas and an assumed southeast groundwater flow direction. Well names were assigned based on the five digit numbering system adopted by ER in 1992. The rationale for each new monitoring well location is summarized in Table 4-4.

Table 4-4 Building 865 Monitoring Well Location Rationale

Well Number	Location	Rationale
01600	West side of Building 865, just north of B827	Monitor upgradient water quality
01700	Northwest corner of Building 865	Monitor upgradient water quality
01800	South side of Building 865, central	Monitor downgradient water quality
40999 (existing)	Just east of Building 865	Monitor downgradient water quality
P317989	90 feet southeast of southeast corner of Building 865	Monitor downgradient water quality

4.1.5 Building 883

Two new monitoring well locations have been chosen to monitor groundwater quality associated with Building 883. One well, 02100, will be located along the south side of the building near the southeast corner, and the other well, 02200, will be located centrally along the east side. These two new wells will monitor downgradient groundwater quality. Existing wells 61099 and 61199 will be utilized to monitor upgradient water quality. The Building 883 foundation drain has a collection sump located beneath the southwest portion of the building. The sump pump is currently not in operation and groundwater from the foundation drain does not enter surface water. Figure 1-4 illustrates the location of the proposed D&D wells and existing wells 61099 and 61199 in relation to Building 883 and surrounding features. Individual well locations were determined with respect to potential contaminant source areas and an assumed southeast groundwater flow direction. Well names were assigned based on the five digit numbering system adopted by ER in 1992. The rationale for each new monitoring well location is summarized in Table 4-5.

Table 4-5 Building 883 Monitoring Well Location Rationale

Well Number	Location	Rationale
02100	South side of Building 883, east of center	Monitor downgradient water quality
02200	East side of Building 883, on pavement just south of intersection	Monitor downgradient water quality
61199 (existing)	East of building 883, 30 feet southwest of southwest corner of B879	Monitor upgradient water quality
61099 (existing)	150 feet northwest of Building 883	Monitor upgradient water quality

4.2 Well Design and Installation

4.2.1 Well Design

The main type of monitoring wells selected for installation at Buildings 707, 776/777, 371/374, 865, and 883 are small diameter wells that are suitable for monitoring shallow (generally less than 25-foot depth) alluvial groundwater. The wells will have screens set through the alluvial saturated zone, and at least 5 feet into weathered bedrock, to detect for lateral migration of contaminants in the UHSU. In some cases, where there is a thin saturated thickness, where groundwater is in the upper portion of the bedrock (weathered zone), or where deep building basements are a concern, wells may be drilled deeper. This may be important in the case of a newly flooded building basement. The screened interval will be selected for all wells to account for seasonal fluctuations in water table depth and the elevation at which potential contaminants are expected to be encountered. Final depth determinations will be made in the field based on actual drilling conditions, initial depth to water, and building history and configuration knowledge. Table 4-6 summarizes proposed D&D well completion information.

At Building 707, the alluvial thickness averages about seven feet and the alluvial saturated thickness is generally one foot or less. Because of the basement depth of approximately 20 feet bgs, the new downgradient D&D monitoring well at the site, 00200, will be approximately 20 feet deep with a screened interval of approximately 5 to 20 feet bgs.

At Building 776/777, the alluvial thickness averages about 10 feet with a very thin to non-existent alluvial saturated thickness. Because of the depth of the elevator pit and tunnel at the northwest corner of Building 776 (approximately 30-35 feet bgs), which also contains process waste lines, new downgradient D&D well 00700 will be approximately 35 feet deep with a screened interval of approximately 5 to 35 feet bgs. Based on the approximate basement depth of 20 feet bgs, new D&D downgradient wells 00600 and 00500 will be approximately 20 feet deep with a screened interval of approximately 5 to 20 feet bgs. New upgradient D&D well 00400 will be approximately 20 feet deep with a screened interval of approximately 5 to 20 feet bgs. If sands of the Arapahoe Formation are encountered, well screens at those monitoring wells will extend to the base of the sand.

At Building 371/374, the alluvial thickness averages about 19 feet with an alluvial saturated thickness of about 11 feet in the southwest portion of the site to about 3 feet in the northeast portion of the site. Based on the depth of the Building 371 sub-basement (approximately 40 feet bgs), new downgradient D&D wells 01300 and 01400 will be approximately 40 feet deep with a screened interval of approximately 10 to 40 feet bgs. Based on the depth of the Building 374 basement (approximately 23 feet bgs), new downgradient D&D well 01200 will be approximately 25 feet deep with a screened interval of approximately 10 to 25 feet bgs. New upgradient D&D wells 00900, 01000, and 01100 will be approximately 20 feet deep with a screened interval of approximately 5 to 20 feet bgs.

At Building 865 the alluvial thickness averages about 6.5 feet with an alluvial saturated thickness of one foot or less. Based on this information, and to intersect any potential UHSU flow in the weathered bedrock, new upgradient D&D wells 01600 and 01700, and new D&D downgradient well 01800 will be approximately 15 feet deep with a screened interval of approximately 5 to 15 feet bgs.

At Building 883 the alluvial thickness averages 13 feet with an average alluvial saturated thickness of 3.6 feet. Based on the basement sump maximum depth (approximately 16 feet), and the location of the basement along the east and northeast portion of the building, new downgradient D&D wells 02100 and 02200 will be approximately 20 feet deep with a screened interval of approximately 5 to 20 feet bgs.

Table 4-6 Summary of Proposed D&D Well Completion Information

Building	Well Number	Well Depth (Ft)	Screened Interval (ft)
779	00100	30	15-25
707	00200	20	5 – 20
776/777	00400	20	5 – 20
776/777	00500	20	5 – 20
776/777	00600	20	5 – 20
776/777	00700	35	5 – 35
371/374	00900	20	5 – 20

Building	Well Number	Well Depth (Ft)	Screened Interval (ft)
371/374	01000	20	5 – 20
371/374	01100	20	5 – 20
371/374	01200	25	10 – 25
371/374	01300	40	10 – 40
371/374	01400	40	10 – 40
865	01600	15	5 – 15
865	01700	15	5 – 15
865	01800	15	5 – 15
883	02100	20	5 – 20
883	02200	20	5 – 20

New monitoring wells will generally be installed using conventional single casing construction methods described in 5-21000-OPS-GT.06, *Monitoring Well and Piezometer Installation.* A specialized surface casing configuration (reference RMRS/OPS-PRO.114) can be utilized if there is known radiological soil contamination at a specific drilling site. Typical well construction materials will consist of 0.75-inch inside diameter (ID), schedule 40 or 80 polyvinyl chloride (PVC) riser and factory cut (0.010-inch slot width) well screen. Silica sand (16-40), bentonite pellets and a betonite slurry are used to complete the wells. For the cases where deeper wells require a truck mounted drilling rig, wells will be constructed of 2-inch ID PVC riser and factory cut (0.010-inch slot width) screen. Flush-mount protective casings will be required to avoid damage in heavily trafficked areas around all buildings and areas that may be subject to D&D traffic.

Although the small diameter of most of these wells precludes the installation of dedicated monitoring devices for low flow rate sampling purposes, the wells should provide for the collection of groundwater samples that are comparable in quality to larger-diameter RFETS monitoring wells sampled with a bailer. Low-flow rate sampling using non-dedicated equipment may be possible for certain analytes provided that well yields are sustainable. It is expected that these monitoring wells will have a serviceable life of approximately five years for D&D monitoring purposes only.

4.2.2 Pre-Drilling Activities

A Soil Disturbance Permit will be obtained before the implementation of field activities associated with this SAP. Before drilling activities begin, all locations will be cleared in accordance with RMRS/OPS-

PRO.102, *Borehole Clearing*, and marked in accordance with RMRS/OPS-PRO.124, *Push Subsurface Soil Sampling*. A radiological survey will be conducted before site work begins in accordance with 5-21000-OPS-FO.16, *Field Radiological Measurements*. All necessary health and safety protocols will be followed in accordance with a project specific addendum to the Groundwater Health and Safety Plan.

4.2.3 Borehole Drilling and Logging

Borings generally will be drilled using push-type techniques (Geoprobe) at proposed well locations. Detailed drilling and sampling procedures using this methodology are provided in OPS-PRO.124. If probe refusal is encountered before reaching the target borehole depth, the boring will be abandoned using procedure OPS-PRO.117, *Plugging and Abandonment of Boreholes*, and an offset boring will be attempted within 3 feet of the original boring. If probe refusal occurs repeatedly, or a much greater depth is required, a truck-mounted hollow-stem auger drill may be procured to complete the boring. Detailed drilling and sampling procedures using this drilling method can be found in OPS-PRO.114, *Drilling and Sampling using Hollow-Stem Auger and Rotary Drilling and Rock Coring Techniques.*

Soil cores will be recovered continuously in at least two-foot increments using a 2-inch diameter (or 2.125-inch diameter for the dual-wall system) by 24- to 48-inch long stainless steel- or lexon-lined core barrel. Cores will be monitored following recovery for health and safety purposes with a Flame Ionization Detector (FID) or a Photoionization Detector (PID), as appropriate, in accordance with Site Procedure 5-21000-OPS-FO.15, *Photoionization Detectors and Flame Ionization Detectors*. The core samples will then be boxed and logged in accordance with OPS-PRO.101, *Logging Alluvial and Bedrock Material,* except that logging will be conducted more qualitatively than specified in OPS-PRO.101 (i.e., sieving, examination with a microscope, and plasticity testing will not be conducted). All core boxes will be labeled and transferred to a core storage conex for archiving following project completion. In the event that coring proves to be impractical or unnecessary, such as for the first 6 feet from ground surface, the well borings may be advanced using a retrievable drive point to allow for more efficient well installation.

4.2.4 Well Installation

Groundwater monitoring wells will be installed in accordance with 5-21000-OPS-GT.06, *Monitoring Well and Piezometer Installation.* Monitoring wells will be land surveyed in accordance with OPS-PRO.123, *Land Surveying*, or current RFETS global positioning system manuals.

4.3 Well Development

Monitoring wells will be developed prior to sampling using the procedures specified in OPS-PRO.106, *Well Development,* with the exception that repeated vigorous surging utilizing a bailer may be employed to expedite formation damage restoration and maximize well yields for groundwater sampling. This approach has the best chance for success in wells containing a sufficient water column for surging and a thin annular sand pack, such as Geoprobe well points. Under these conditions, the removal of fines associated with formation damage can be more effectively accomplished because a much greater amount of surging energy is transmitted through the sand pack to dislodge materials at the borehole wall interface compared to wells completed with thick annular sand packs. All water produced during well development will be handled as uncharacterized development water in accordance with 4-H66-ER-OPS-FO.05, *Handling of Purge and Development Water.*

4.4 Sample Designation

The site standard sample numbering system will be implemented in this project. Location codes have been assigned to individual wells as shown in Figures 1-1, 1-3, and 1-4, and as listed in Tables 4-1, 4-2, 4-3, 4-4, and 4-5, using the Analytical Services Division (ASD) procedure ASD-003, *Identification System for Reports and Samples.* For each groundwater sample collected from a well, dual sample numbers will be assigned: 1) a standard RIN sample number (i.e., 98AXXXX.00X.00X) will be assigned to the project by the ASD, and 2) an RMRS sample number (i.e. GW0XXXXTE) will be assigned for internal sample tracking. The block of sample numbers will be of sufficient size to include the entire number of possible samples (including QA samples) and location codes. For reporting purposes, the ASD and RMRS sample numbers will be cross-referenced with location codes.

4.5 Sample Collection

Prior to sample collection, the water level will be measured according to OPS-PRO.105, *Water Level Measurements in Wells and Piezometers*, to determine purge water requirements. During the initial sampling round, additional water level measurements will also be taken from the following existing wells to aid in potentiometric map construction for the interpretation of groundwater quality data:

Buildings 707 and 776/777:

P215789	22896	02497	02297	60099	60699
P213689	22696	02397	05293	60299	

Building 371/374:

P119389	21798	21998
22596 .	21898	22098

44

<u>Buildings 865 and 883:</u>

60999	61299	P313589	41199
6186	37791	41099	

Groundwater samples will be collected using the methods specified in OPS-PRO.108, *Measurement of Groundwater Field Parameters*, and OPS-PRO.113, *Groundwater Sampling,* as modified for small diameter well points. Sampling procedures will be further modified for wells that prove to be incapable of yielding a full sample suite over the sampling period currently specified in OPS-PRO.113, *Groundwater Sampling.* These wells will be revisited and sample collection will continue as long as the well recharges sufficiently to warrant repeated sampling visits. Low flow rate sampling methods will be implemented for metals and radiological isotopes if all wells prove to be capable of providing a sustainable yield of 100 ml/minute or greater with minimal drawdown; otherwise, sampling will be performed with a small diameter bailer. After an initial sampling round is completed for all new wells, sampling of selected wells will be conducted on a semi-annual basis in support of D&D monitoring for the first year, as specified by the IMP (to be modified if D&D schedules are accelerated). After the first year, D&D sampling schedules will be addressed in the IMP.

Surface water samples will be collected in accordance with RMRS/OPS-PRO.081, *Surface Water Sampling.*

If necessary, a Health and Safety Specialist (HSS) or Radiological Control Technician (RCT) will scan each sample with a Field Instrument for the Detection of Low Energy Radiation (FIDLER) and equipment will be monitored for radiological contamination during and after sampling activities. All sampling equipment will be decontaminated with a Liquinox solution, and rinsed with deionized or distilled water, in accordance with 4-S01-ENV-OPS-FO.03, *Field Decontamination Operations.* Other sampling equipment will include standard items such as chain of custody seals and forms, field forms, etc.

Health and safety requirements will be specified in the project specific addendum to the Groundwater Health and Safety Plan. Personal protective equipment (PPE), air monitoring requirements, and hazard assessments will be addressed in the project specific addendum to the Groundwater Health and Safety Plan.

4.6 Sample Handling and Analysis

Samples will be handled according to RMRS/OPS-PRO.069, *Containing, Preserving, Handling, and Shipping of Soil and Water Samples.*

Table 4-7 indicates the analytical requirements for each analyte. Samples will be submitted to an offsite, EPA-approved laboratory for analysis under a 30-day result turnaround time.

Table 4-7 Analytical Requirements for Groundwater Samples

Analysis	Building	Matrix	EPA Method/ ASD Module [a]	Container	Preservation	Holding Time
Target Analyte List (TAL) Metals	707, 779, 776/777, 371/374, 865, 883	Water	EPA CLP plus additional metals	1 (one) 1-liter poly bottle	Field filtered (0.45 µm membrane), Cool to 4° C, HNO_3 to pH<2	180 Days
Target Compound List (TCL) Volatiles	707, 779, 776/777, 371/374, 865, 883	Water	EPA 524.2	3 (three) 40 ml amber glass (AG) vials with teflon-lids	Unfiltered, Cool to 4° C	14 days
Nitrates	776/777, 371/374, 865,883, 779	Water	EPA 300 Methods	1 (one) 250 ml poly bottle	Cool to 4° C, H_2SO_4 to pH<2	28 days
Uranium Isotopes (U233/ 234, U235, and U-238)	707, 779, 776/777, 371/374, 865,883	Water	ASD Module RC01-B.3	1 (one) 1-liter poly bottle	Field filtered (0.45 µm membrane), HNO_3 to pH<2	180 days
Am-241, Pu-239/240	707, 779, 776/777, 371/374	Water	ASD Module RC01-B.3	1 (one) 1-gallon poly bottle	Unfiltered, HNO_3 to pH<2	180 days
Neptunium 237	707	Water	ASD Line Item Code TR01A193	1 (one) 1-gallon poly bottle	Unfiltered, HNO_3 to pH<2	180 days
Tritium	776/777	Water	ASD Module RC02-B.1	1 (one) 125 ml glass bottle	None	None
Rad Screen	707, 779, 776/777, 371/374, 865, 883	Water	ASD Line Item Code OS01A002	1 (one) 125 ml poly bottle	Unfiltered	180 days
TPH (TVPH + TEPH)[b]	707, 776/777, 371/374, 883	Water	EPA 8015 Modified	TVPH-3, 40ml VOA; TEPH-2, 500ml AG	HCl to pH<2, Cool to 4° C	14 days
PCBs[b]	707, 883	Water	EPA 8081	1 (one) 1-liter AG	Cool to 4° C	7 days

[a] No EPA-approved method is currently in place for radionuclide analyses. However, guidance is provided in procedures defined in the ASD Modules and appropriate line item codes.

[b] If no detections during the first round then discontinued. See text below.

VOC samples will be collected first. Radiological samples will be the highest priority after VOC samples have been collected. After radiological samples the priority will be nitrates, metals, and miscellaneous samples (TPH and PCBs).

The list of analytes in Table 4-7 may be modified on a yearly basis as is provided for in the IMP. At Buildings 707, 776/777, 371/374 and 883 initial groundwater samples will be collected and analyzed for Total Petroleum Hydrocarbons (TPH); at Buildings 707 and 883 an initial groundwater sample will be collected and analyzed for polychlorinated biphenyls (PCBs). Because of historical practices at the buildings, there is some potential for these analytes in groundwater. If there are no detections for these analytes from the respective buildings, then they will be removed from the sampling program after the first sampling round.

4.7 Equipment Decontamination and Waste Handling

Reusable sampling equipment will be decontaminated in accordance with procedure 4-S01-ENV-OPS-F0.03, *Field Decontamination Operations*. Decontamination waters generated during the project will be managed according to procedure OPS-PRO.112, *Handling of Decontamination Water and Wash Water*. Geoprobe equipment will be decontaminated following project completion using procedure OPS-PRO.070, *Decontamination of Equipment at Decontamination Facilities*.

5.0 DATA MANAGEMENT

A project field logbook will be created and maintained by the project manager or designee in accordance with Site Procedure 2-S47-ER-ADM-05.14, *Use of Field Logbooks and Forms*. The logbook will include the time and date of all field activities, sketch maps of sample locations, and any additional pertinent information not specifically required by the SAP. The originator will legibly sign and date each completed original hard copy of data. Appropriate field data forms will also be utilized when required by the operating procedures that govern the field activity. A peer reviewer will examine each completed original hard copy of data. Any modifications will be indicated in ink, and initialed and dated by the reviewer. Logbooks will be controlled through RMRS Document Control.

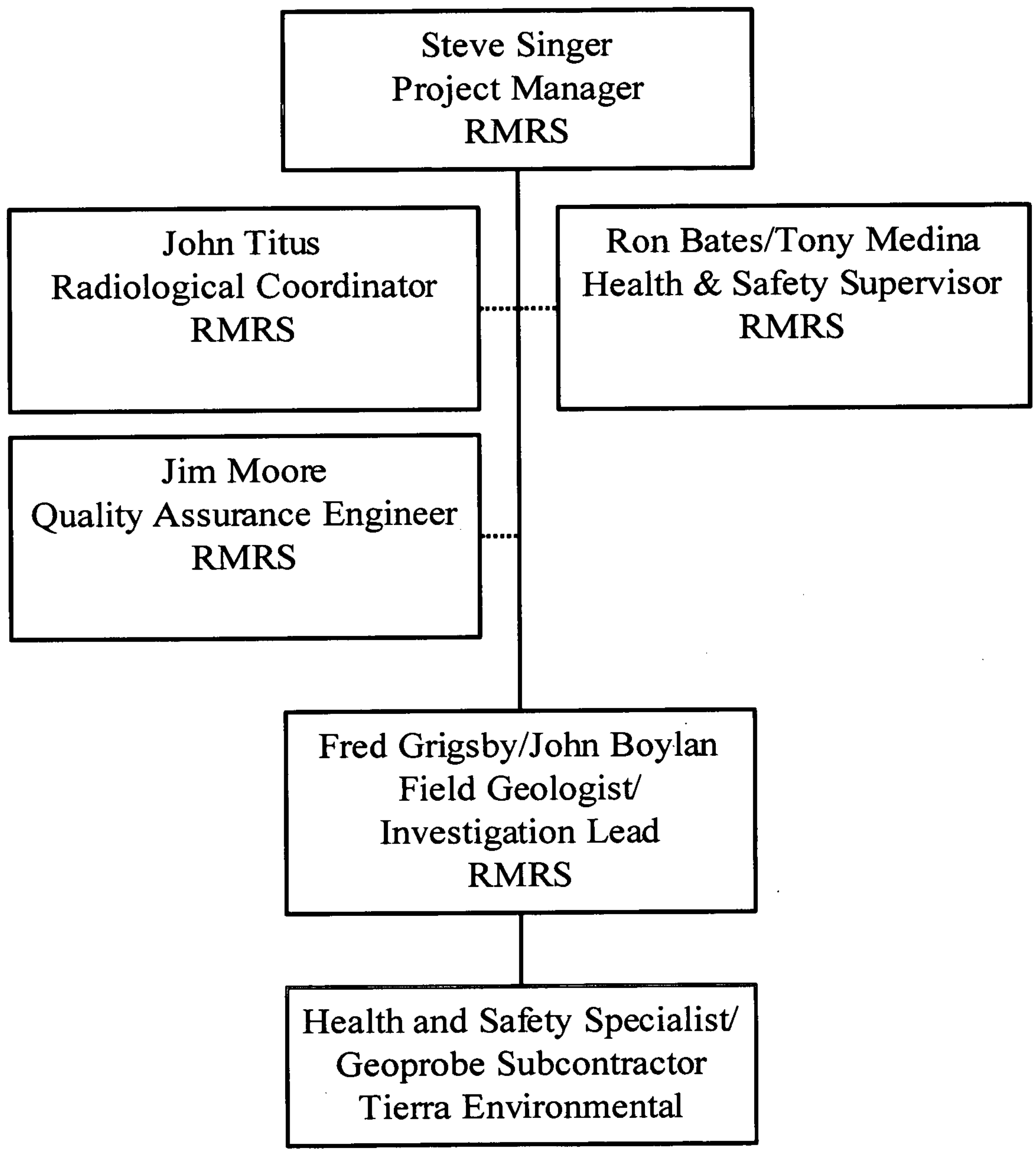
Analytical data record storage for this project will be performed by KH-ASD. Sample analytical results will be delivered directly from the laboratory to KH-ASD in an Electronic Disc Deliverable (EDD) format and archived in the Soil and Water Database (SWD) as per RMRS/OPS-PRO.072, *Field Data Management.* Hard copy records of laboratory results will be obtained from KH-ASD in the event that the analytical data is unavailable in EDD or SWD at the time of report preparation. Groundwater analytical results will be compiled into a sampling and analysis report.

6.0 PROJECT ORGANIZATION

Figure 6-1 illustrates the project organization structure. The RMRS Groundwater Operations Project Manager (PM) will be responsible for maintaining data collection and management methods that are consistent with Site operations. The PM is the individual responsible for overall project execution from pre-conceptual scoping through project implementation and closeout. Other individuals assisting with the implementation of this project are the RMRS Health and Safety Supervisor who is responsible for overall compliance with and implementation of the Project Health and Safety Plan. The RMRS Quality Assurance Engineer will provide the first level of oversight and support implementation of quality controls within all quality-affecting activities of the project. The RMRS Radiological Engineer is responsible for overseeing the development and implementation of and ensuring compliance with the radiological aspects of the Project Health and Safety Plan, As Low As Reasonably Achievable (ALARA) Job Review, soil disturbance evaluations, and approval of applicable Radiological Work Permits (RWPs).

The Field Geologist/Investigation Lead will be responsible for field data collection, documentation, directing drilling, and well installation. They will oversee the Health and Safety Specialist who will be responsible for onsite compliance with and implementation of the Project Specific Health and Safety Plan. In addition, they will also oversee sampling personnel responsible for field data collection, sample collection, and transfer of samples for analysis. Field data collections will include sampling and obtaining screening results. Documentation will require field logs and completing appropriate forms for data management and chain-of-custody shipment. The sampling crew will coordinate sample shipment for on-site and off-site analyses through the ASD personnel. The sampling personnel are responsible for verifying that chain-of-custody documents are complete and accurate before the samples are shipped to the analytical laboratories.

Figure 6-1 Buildings 707, 776/777, 371/374, 865 and 883 D&D Groundwater Monitoring Organization Chart



- Design;
- Procurement;
- Inspection/Acceptance Testing;

7.0 QUALITY ASSURANCE

All components and processes within this project will comply with the RMRS Qualify Assurance Program Description RMRS-QAPD-001, Revision 3, September 13, 1999, which is consistent with the K-H Team QA Program. The RMRS QA Program is consistent with quality requirements and guidelines mandated by the EPA, CDPHE, and DOE. In general, the applicable categories of quality control are as follows:

- Quality Program;
- Training;
- Quality Improvement;
- Documents/Records;
- Work Processes;
- Management Assessments; and
- Independent Assessments.

The project manager will be in direct contact with QA to identify and correct issues with potential quality affecting issues. Field sampling quality control will be conducted to ensure that data generated from all samples collected in the field for laboratory analysis represents the actual conditions in the field. The confidence levels of the data will be maintained by the collection of QC samples, consisting of duplicate samples and equipment rinsate samples.

Duplicate samples will be collected on a frequency of one duplicate sample for every twenty real samples. Rinsate samples will be generated at a frequency of one rinsate sample for every 20 real samples collected. Data validation will be performed on 25% of the laboratory data according to the Rocky Flats ASD, Performance Assurance Group procedures. Samples will be randomly selected from adequate sample sets (RINS) by ASD personnel to fulfill data validation of 25% of the total number of VOC and radioisotope analyses. Table 7-1 provides the QA/QC samples and frequency requirements of QC sample generation.

Table 7-1 QA/QC Sample Type, Frequency, and Quantity

Sample Type	Frequency	Comments	Estimated Quantity
Duplicate	One duplicate for each twenty real samples		2
Equipment Rinsate Blank	One rinse blank for each twenty real samples	To be performed with reusable sampling equipment following decontamination procedures	2

Analytical data that is collected in support of this SAP will be evaluated using the guidance developed by the RMRS procedure RF/RMRS-98-200, *Evaluation of Data for Usability in Final Reports*. This procedure establishes the guidelines for evaluating analytical data with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters.

A definition of PARCC parameters and the specific applications to the investigation are as follows:

<u>Precision</u>. A quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter. The closer the numerical values of the measurements are to each other, the lower the relative percent difference and the greater the precision. The relative percent difference (RPD) for results of duplicate and replicate samples will be tabulated according to matrix and analytical suites to compare for compliance with established precision DQOs. Specifications on repeatability are provided in Table 7-2. Deficiencies will be noted and qualified, if required.

<u>Accuracy</u>. A quantitative measure of data quality that refers to the degree of difference between measured or calculated values and the true value of a parameter. The closer the measurement to the true value, the more accurate the measurement. The actual analytical method and detection limits will be compared with the required analytical method and detection limits for VOCs and radionuclides to assess the DQO compliance for accuracy.

<u>Representativeness</u>. A qualitative characteristic of data quality defined by the degree to which the data absolutely and exactly represents the characteristics of a population. Representativeness is accomplished by obtaining an adequate number of samples from appropriate spatial locations within the medium of interest. The actual sample types and quantities will be compared with those stated in the SAP or other related documents and organized by media type and analytical suite. Deviation from the required and actual parameters will be justified.

<u>Completeness</u>. A quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained from a measurement system. A completeness goal of 90% has been set for this SAP. Real samples and QC samples will be reviewed for the data usability and achievement of internal DQO usability goals. If sample data cannot be used, the non-compliance will be justified, as required.

<u>Comparability</u>. A qualitative measure defined by the confidence with which one data set can be compared to another. Comparability will be attained through consistent use of industry standards (e.g., SW-846) and standard operating procedures, both in the field

and in laboratories. Statistical tests may be used for quantitative comparison between sample sets (populations). Deficiencies will be qualified, as required. Quantitative values for PARCC parameters for the project are provide in Table 7-2.

Laboratory validation shall be performed on 25% of the characterization data collected in support of this project. Laboratory verification shall be performed on the remaining 75% of the data. Data usability shall be performed on laboratory validated data according to procedure RF/RMRS-98-200, *Evaluation of Data for Usability in Final Reports*.

Table 7-2 PARCC Parameter Summary

PARCC	Radionuclides	Non-Radionuclides
Precision	Duplicate Error Ratio ≤ 1.96	RPD ≤ 30% for Organics RPD ≤ 30% for Non-Organics
Accuracy	Detection Limits per method and ASD Laboratory SOW	Comparison of Laboratory Control Sample Results with Real Sample Results
Representativeness	Based on SOPs ,SAP, and analytical methods	Based on SOPs, SAP, and analytical methods
Comparability	Based on SOPs and SAP	Based on SOPs and SAP
Completeness	90% Useable	90% Useable

Data validation will be performed according to KH-ASD procedures, but will be done after the data is used for its intended purpose. Analytical laboratories supporting this task have all passed regular laboratory audits by KH-ASD.

8.0 SCHEDULE

Well installation activities are scheduled to be completed during calendar year 2000. Well development and groundwater sampling will commence within one week of well completions. Measurement of water levels from existing monitoring wells for potentiometric map construction will be conducted within one week of groundwater sampling to ensure representative water table elevation data. Results of investigations based on this SAP will be reported in future quarterly and annual RFCA groundwater reports.

9.0 REFERENCES

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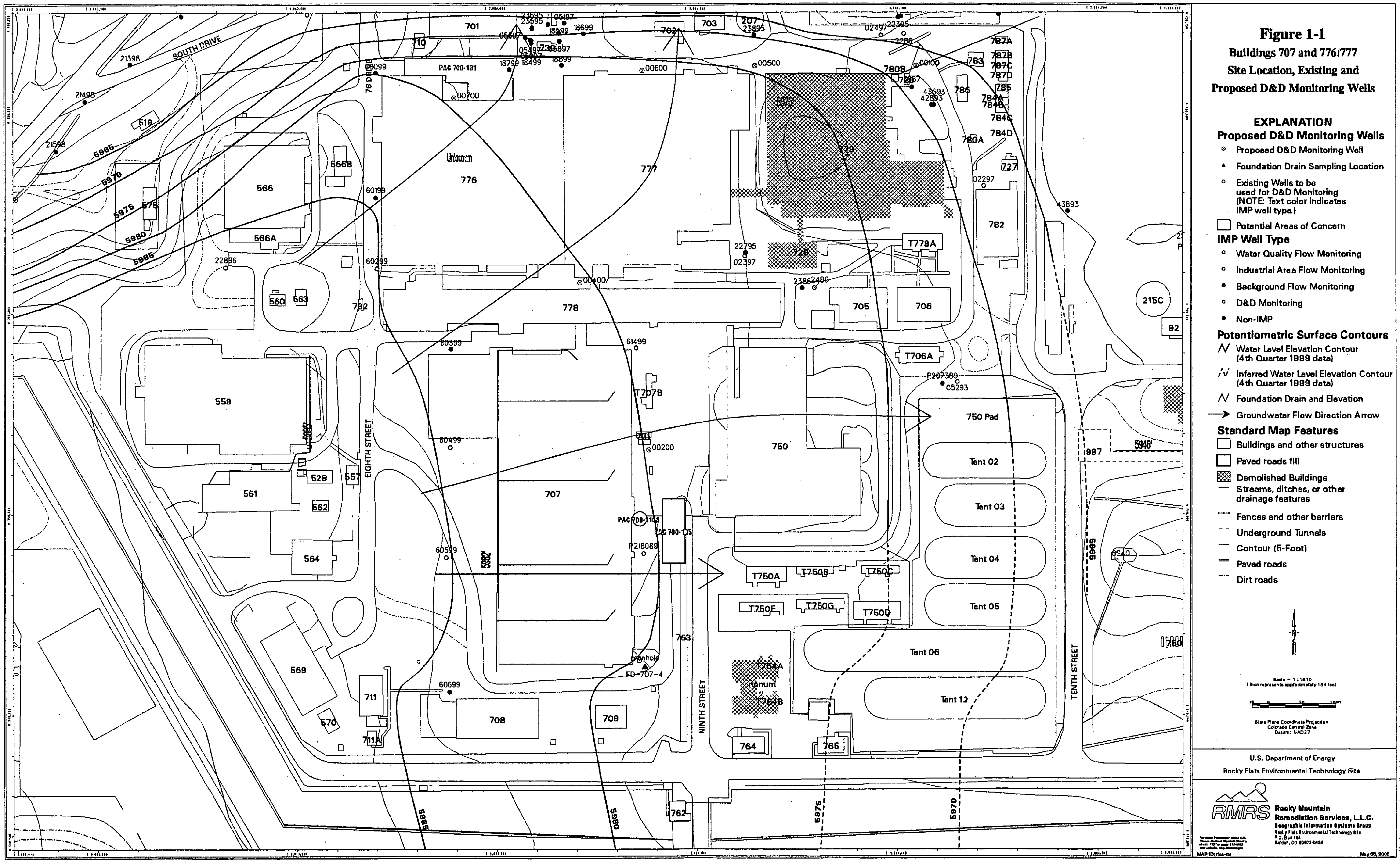

Figure 1-1
Buildings 707 and 776/777 Site Location, Existing and Proposed D&D Monitoring Wells

NT_Svr w:/projects/fy2k/2k-0100/location_maps/bldg_707-776-777.aml

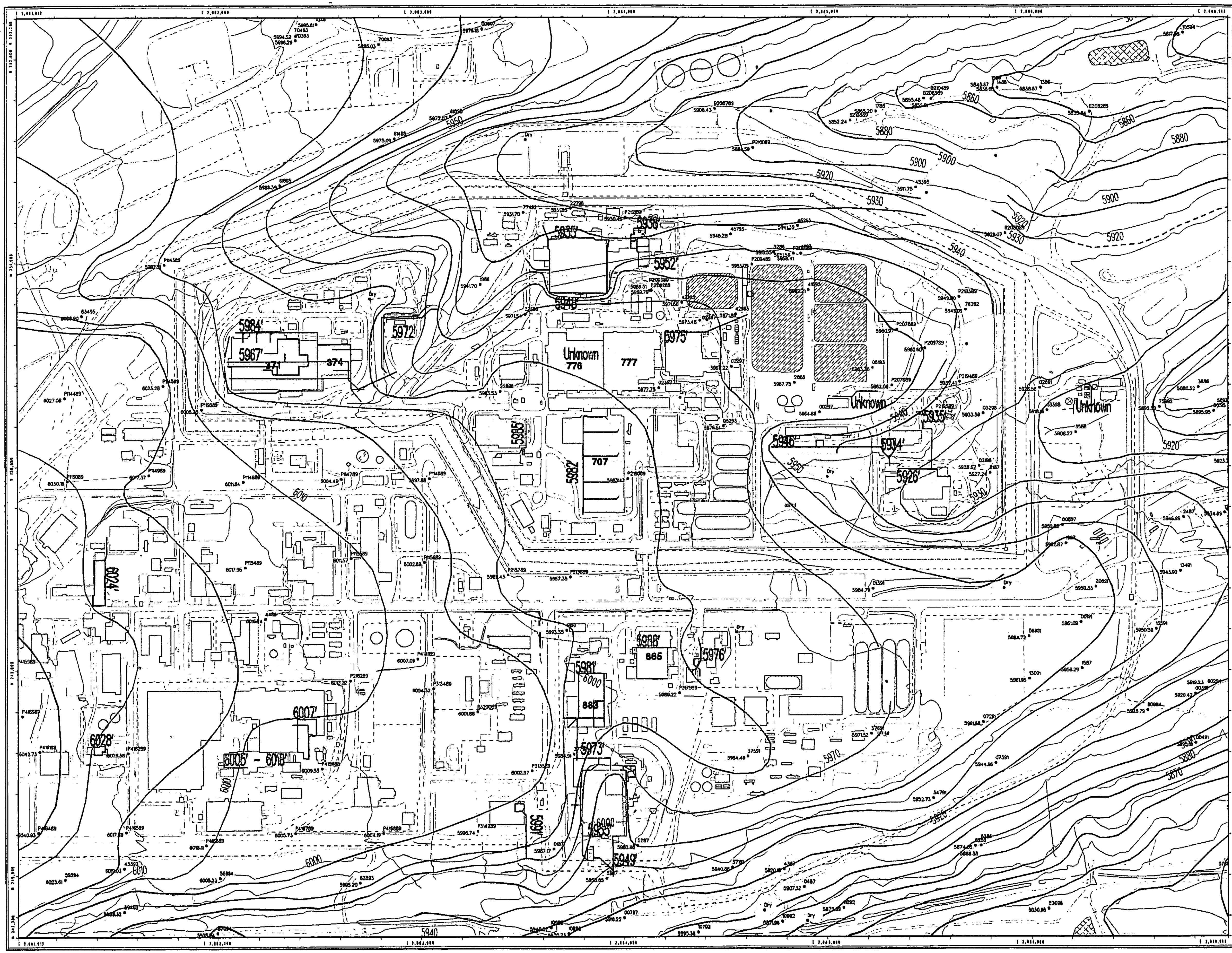

Figure 1-2
Potentiometric Surface of Unconsolidated Surficial Deposits Second Quarter 1998

- Groundwater Monitoring Well
- Water Level Contour
- Dashed where inferred
- Intermediate Water Level Contour
- Dashed where inferred
- Foundation Drain and Elevation
- Approximate extent of Unsaturated Area
- Area without Groundwater Elevation Data

Standard Map Features

- Buildings & other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contours (20' Intervals)
- Roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs. 1/95

Scale = 1 : 5810
1 inch represents approximately 484 feet

100 0 200 400ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
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MAP ID: 2k-0100

February 09, 2000

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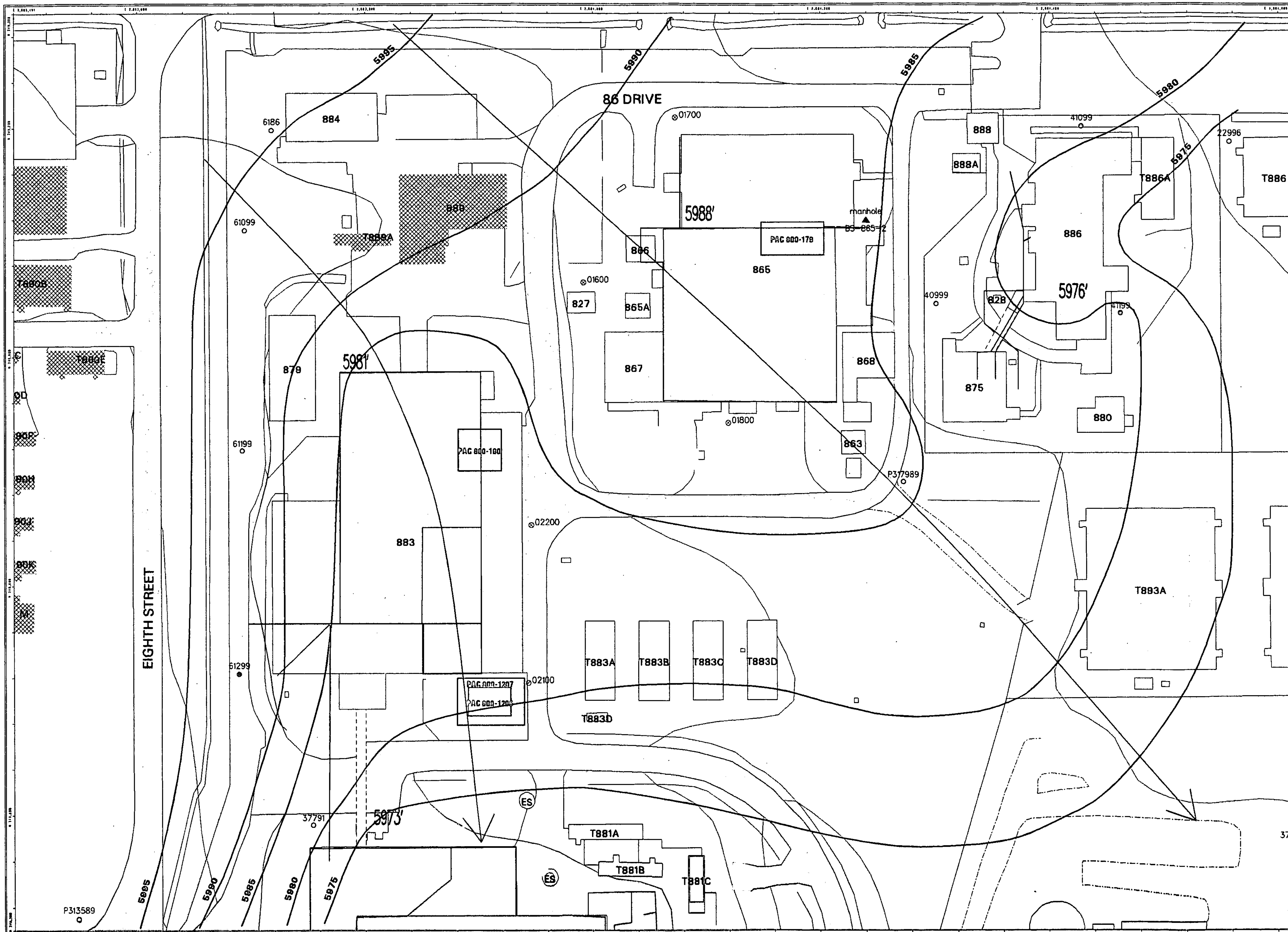

Figure 1-4

Buildings 865 and 883
Site Location, Existing and
Proposed D&D Monitoring Wells

EXPLANATION

Proposed D&D Monitoring Wells

- Proposed D&D Monitoring Well
- Foundation Drain Sampling Location
- Existing Wells to be used for D&D Monitoring (NOTE: Text color indicates IMP well type)
- Potential Areas of Concern

IMP Well Type

- Water Quality Flow Monitoring
- Industrial Area Flow Monitoring
- Background Flow Monitoring
- D&D Monitoring
- Non-IMP

Potentiometric Surface Contours

- Water Level Elevation Contour (4th Quarter 1999 data)
- Inferred Water Level Elevation Contour (4th Quarter 1999 data)
- Foundation Drain and Elevation
- Groundwater Flow Direction Arrow

Standard Map Features

- Buildings and other structures
- Paved roads fill
- Demolished Buildings
- Streams, ditches, or other drainage features
- Fences and other barriers
- Underground Tunnels
- Contour (5-Foot)
- Paved roads
- Dirt roads

N

Scale = 1 : 1030
1 inch represents approximately 86 feet

25 0 50 100ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
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P.O. Box 464
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MAP ID: ifcos-rpt

May 08, 2000

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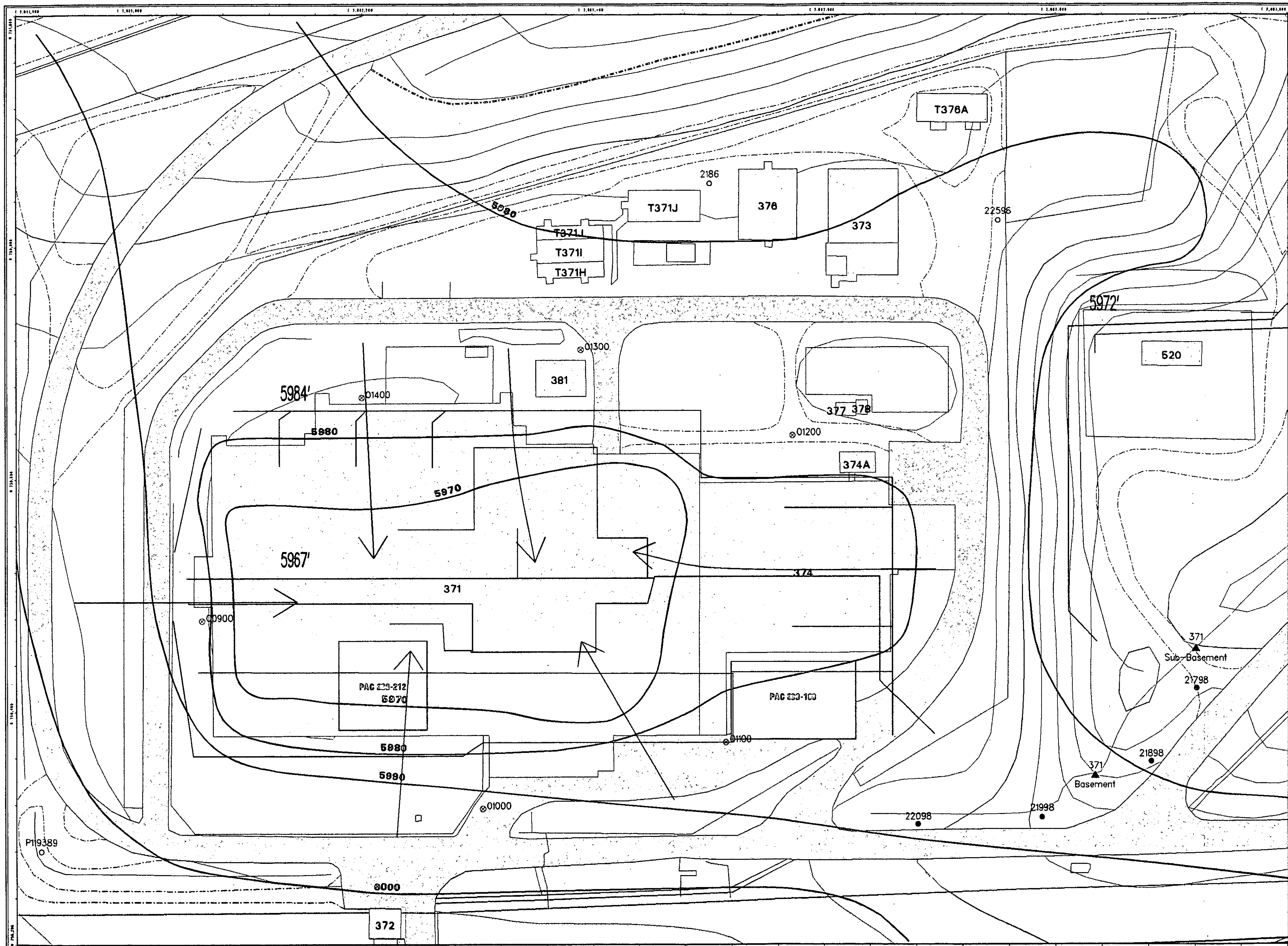

Figure 1-3
Building 371/374
Site Location, Existing and Proposed D&D Monitoring Wells

EXPLANATION

Proposed D&D Monitoring Wells
- Proposed D&D Monitoring Well
- Foundation Drain Sampling Location
- Potential Areas of Concern

IMP Well Type
- Water Quality Flow Monitoring
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Potentiometric Surface Contours
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- Dirt roads

Scale = 1 : 1020
1 inch represents approximately 85 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

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